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INITIAL REPORT

ON

DEMONSTRATION PROJECT NO. 55, ASPHALT EMULSIONS FOR HIGHWAY CONSTRUCTION

WORK ORDER NO.
DTFH-71-81-55-RI-01

COMPLETED
76

ISSUED BY:

U.S. Department of Transportation
Federal Highway Administration
Demonstration Projects Division
1000 North Glebe Road
Arlington, Virginia 22201

COOPERATING AGENCY:

Town of South Kingstown
Department of Public Works
66 High Street
Wakefield, Rhode Island 02879

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December, 1981

Revised
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ABSTRACT

During the summer of 1981, asphalt emulsion chip seals were placed on Dug-Way-Bridge, Glen Rock Road, James Trail, and Liberty Lane in the town of South Kingstown, Rhode Island. The purpose was to gain experience in emulsion chip seal design, construction procedures, and performance of the surface while evaluating the economics, energy requirements, and environmental impacts. This experience will be valuable when the State mandates a reduction of cutback asphalt.

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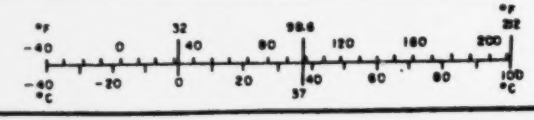
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Introduction

The Town of South Kingstown, RI is a rural, coastal community with a population of 22,000 and encompasses an area of approximately 63 square miles. Several facts lend to the uniqueness of the Town; it has the second largest land area of any community in the State, it has the second largest population of any community in southern Rhode Island, it has a business district serving several smaller neighboring communities, it is the home of the University of Rhode Island, it attracts a large influx of summer residents and vistors with its beaches and related recreational areas, and it has an Amtrak passenger station serving the community. Because of these facts, the 120 miles of Town owned and maintained surfaced roads are subject to unusually high volumes of traffic.

Over the years the Town has progressed in its maintenance procedures on the roads. Through the 1960's, the majority of all roads were sand sealed on an average of every ten years. During the early 1970's a bituminous paving program was tried but was found to be too costly. The bituminous paved roads were also found to show signs of early failure due to insufficient drainage and improper base materials. The mid and late 1970's also saw some of the in-town streets treated with bituminous pavement after the installation of sanitary sewers. Still, the majority of streets in the town remained sand sealed and this type of maintenance was continued throughout the 1970's in addition to the other programs. In 1979 three different types of surfacing were tried; sand chip sealing, 3/8" native stone sealing, and 3/8" blue chip stone sealing. All sand sealing was eliminated. In 1980 half of the roads sealed were sand chip sealed while the other half was 3/8" blue chip sealed. From this brief history it can be seen that the Town is continually searching for the most economical and long life surface that can be obtained.

It is this economic concern as well as the concern for the environment that has led the Town to try liquid emulsion asphalt. While the State of Rhode Island has no present program to limit the use of cutback asphalts, the neighboring states of Massachusetts and Connecticut do have such programs due to their greater volume of use. Liquid emulsions have been available for use in this State for a number of years. Because of a lack of familiarity with the products and a reputation of difficulties in application and a less durable end product, use of liquid emulsions has been limited. During 1981 the Town sealed just over 60,000 square yards (of the approximately 132,000 square yards total) using liquid emulsion asphalt. From this experiment the Town will gain; experience in design, first hand knowledge in construction procedures, information on the performance of the product, and an evaluation of the energy used, costs, and environmental impacts. When the State mandates a reduction in the use of cutback asphalt, the Town will be prepared to operate under the new program.

Preliminary Investigation

Four state-aid roads were selected for treatment and evaluation in this project; Dug-Way-Bridge Road, Glen Rock Road, James Trail, and Liberty Lane. Detailed average daily traffic data is unavailable for any and all roads in the Town. The roads selected were connector type streets in predominantly rural, residential areas. From the map in Appendix A it can be seen that Glen Rock Road leads into the neighboring community Exeter from State Route 138 and is used extensively by through-traffic. James Trail extends between Glen Rock Road and the neighboring community of Richmond. Dug-Way-Bridge Road runs between State Route 138 and Glen Rock Road. Liberty Lane in conjunction with Fairgrounds Road is used as a short cut between State Route 2 and State Route 138. Traffic from northbound Route 2 also uses Liberty Lane as an entrance to a small industrial

area located on Liberty Lane and Fairgrounds Road. Some truck traffic can be expected on all the roads with Liberty Lane receiving the most. Speed limits on each of the roads is posted as 25 MPH, but traffic speeds of 40 MPH are common in all cases. Growth rates for the Town as a whole, based on Statewide Planning projections show an expected population of 26,200 by the year 2000, an increase close to 20 percent. Both neighboring communities of Exeter and Richmond are also in a growth situation.

The lengths and average widths of each of the roads are as follows: Dug-Way-Bridge Road 4915 feet by 24 feet, Glen Rock Road 8673 feet by 23 feet, James Trail 1943 feet by 16 feet, and Liberty Lane 7303 feet by 23 feet. Each of the roads is a two lane road except; Dug-Way-Bridge Road and Glen Rock Road on the approaches to the one lane Dug-Way-Bridge, Glen Rock Road narrows to one lane approaching the Town of Exeter, and James Trail has numerous one lane sections. Dug-Way-Bridge Road and Liberty Lane have grades ranging from zero to three percent. Glen Rock Road grades range from zero to eight percent and James Trail has grades from one to ten percent. Each of the roads has at least two sharp horizontal curves with James Trail having several such curves. A crown of three to eight inches is prevalent on all the roads except for a few superelevated areas.

A brief history of the acceptance and maintenance of each of the roads has been gleaned from Town records.

Dug-Way-Bridge Road accepted March 5, 1749

12-19-39	Sealed (1650 feet)
11-27-57	Repaired bridge
9-11-67	Sealed (complete)
8-16,21-72	Honed (complete)
7-18-73	Sealed (complete)
8-76	Rebuilt Bridge
7-1-81	Honed (2482 feet starting 1500 feet north from Route 138)
8-14-81	Replaced 16 feet of 12 inch RCP that was failed 365 feet north of Route 138

Glen Rock Road		accepted August, 1858
6-61	Sealed - with double seal on shoulders (complete)	
9-7-66	Sealed - complete	
7-70	Honed from Dug-Way-Bridge Road to Route 138	
10-4-71	Sealed from Dug-Way-Bridge Road to Route 138	
8-76	Install three (3) catch basins and 263 feet of 15 inch RCP 1000 feet north of Route 138	
8-17-81	Replaced 12 inch MCP with 12 inch RCP (32' long) 765 feet north of Dug-Way-Bridge Road	
8-19-81	Replaced two 24 inch MCP with two 24 inch RCP (32' long) 765 feet north of Dug-Way-Bridge Road	
James Trail		accepted by Tradition
	No maintenance history available. Observation indicates road has been honed and sealed previous to this time.	
Liberty Lane		accepted May, 1874
1961	Honed from New Haven Railroad to Route 2	
9-24,25-68	Honed from New York, New Haven, and Hartford Railroad to Route 2	
9-3,5,11-69	Sealed (complete)	
7-18-74	Sealed (complete)	
7-6-81	Honed (1848 feet starting 1500 feet from Route 2)	
8-20-81	Replaced 18 inch MCP with 18 inch RCP (36 feet long) 3580 feet north of Amtrak	
8-21-81	Replaced 18 inch MCP with 18 inch RCP (32 feet long) 2300 feet north of Amtrak	
8-24-81	Replaced 2 feet by 3 feet stone culvert with 24 inch RCP (32 feet long) 3235 feet north of Amtrak	

All of the above records are obviously incomplete, but all that is available. There are numerous culverts and stone bridges under all the roads (except James Trail which has no drainage) with no records of installation. Also, the roads have been sealed for a number of years before most of the records indicate.

The above history indicates that the sub base on the roads was original soil stabilized by time and traffic. James Trail is nearly all over ledge as indicated by the outcropping along the road. Base course for the road is bank run gravel in varying degrees of depth and built up by continuous grading of the old road. The gravel surfaces were at some point in time penetrated and sand sealed. Surfaces were then built up by repeated sand sealings and occasional honings

over a period of years. A pavement rating form was completed for each road before the stone sealing was done and is included with the pictures of the roads (see Appendix D). Both the pictures and pavement rating form indicate the extent of traverse cracks, longitudinal cracks, alligator cracks, shrinkage cracks, rutting, stripping, and pot holes on all the streets.

The pictures also reveal the slick road conditions that were common before stone sealing. No skid numbers are available to this department. Accident data for each of the roads during 1981 was provided by the Police Department.

	1978	1979	1980	1981
Dug-Way-Bridge Road	N/A	N/A	N/A	0
Glen Rock Road	N/A	N/A	N/A	0
James Trail	N/A	N/A	N/A	1
Liberty Lane	2	1	1	0

Information on accidents prior to 1981 was available for Liberty Lane only.

Climate conditions for the area are as follows:

	Mean Monthly Temperatures	Mean Monthly Precipitation
January	28.4	3.52
February	29.7	3.45
March	36.5	3.99
April	45.8	3.72
May	55.5	3.49
June	64.2	2.65
July	69.7	2.85
August	68.6	3.90
September	61.9	3.26
October	52.5	3.27
November	42.4	4.52
December	31.6	4.13

Freeze-thaw conditions are frequent during five months of the year. Prevailing winds are northwesterly in the winter and southwesterly in the summer with an average annual speed of 10.8 mph. The area is subject to periodic foggy conditions.

There is minimal subsurface drainage on all of the roads. Generally, the roads

are crowned sufficiently to drain all water to the shoulder and off the road or allows the water to follow the shoulder to a waterway off the road. There are numerous cross culverts or stone bridges carrying streams beneath the roads or acting as equalizers in swamp areas. The only road with any actual system is Glen Rock Road which has eight catch basins and connecting pipes in three different locations. A special case is James Trail which has severe slopes, has no drainage systems, and drains by gravity.

Design Criteria/Procedure

The objective of the surface treatment was to seal all cracks, add a wearing surface to the road, and improve skid resistance of the surface. This was to be accomplished by blue chip stone sealing over the existing sand seal surface which was patched prior to stone sealing.

The asphalt emulsion selected for use was an anionic rapid setting emulsion (RS-2). The base asphalt was an anionic rapid setting emulsion (RS-2). The base asphalt was a blend of foreign and domestic crude imported by John J. Hudson, Inc., Providence, Rhode Island, processed by Triram Corporation, Framingham, Massachusetts, and distributed by Ahern Corporation, East Providence, Rhode Island. Data on the emulsion asphalt was as follows:[1]

Asphalt Residue (RS-2) - 67%

Viscosity - 150 at 122°F

Demulsibility - 70%

Sieve Test - 0.05%

Penetration Test - 150

Ductility - 50 (con)

Solubility in Trichlorsethylene - 99%

Emulsifyer - anionic

[1]Data provided by Ahern-Able Companies

Cover stone selected was blue chip stone or keystone described in the Road Oiling Contract as follows:

A clean, hard, durable stone consisting of 100% crushed particles. The material shall have a maximum percentage of wear of not more than that determined by AASHTO T 96 (Los Angeles Abrasion Test). It shall be graded to meet the following requirements:

Sieve Size	Gradation - % Passing
3/4"	100
1/2"	90-100
3/8"	30-36
#4	0-15
#8	0-5

The above aggregate materials shall have a maximum percentage of loss of 12% (AASHTO T 104) and a maximum percentage of wear of 30. Stone shall be treated in a mix plant or pugmill at a rate of two (2) to three (3) gallons per ton using cutback asphalt MC-30 or MC-70, or asphalt emulsion CSS-1H. Sufficient stone shall be treated and stock piled on location for entire project.

The above specification covered a 3/8" stone which was primarily used on the roads. A 1/2" stone for which no specification was given was used on 4740 feet of Glen Rock Road. Able Bituminous Contractors, Inc., East Providence, Rhode Island was the contractor on the project and supplied the aggregate and trucking for the aggregate. Sources of the cover stone were M.A. Gammino Construction Co., Cranston, Rhode Island for 3/8" stone and J.H. Lynch & Sons, Inc., Cumberland, Rhode Island for 1/2" stone.

Design procedures were coordinated with the engineer from Ahern-Able Companies. Application rates for the emulsion and spread rates for the aggregate were based on his prior experience with the products. An application rate of 0.30 gallons of emulsion per square yard and a spread rate of 25 pounds of stone per square

yard was used for the 3/8" stone. An application rate of 0.35 gallons of emulsion per square yard and a spread rate of 28 pounds of stone per square yard was used for the 1/2" stone.

Traffic control was the responsibility of the Town. Each road would be done in sections with the treated section being closed to all but local traffic during the construction. Each section would be kept closed for at least two hours after the application of the surface treatment. All local traffic would be stopped and advised to pass at own risk and travel very slowly over the fresh application.

All work (except for traffic control) was covered by the Road Oiling Contract included in Appendix B. The contract also specifies materials, equipment, and methods.

Construction Criteria/Procedure

During the winter of 1980-81 and the spring of 1981 a grader was used to remove the heavy build-up of sand, soil, and vegetation that was found on the edge of the pavements. This material was wind-rowed, loaded, and trucked away. A power sweeper followed removing excess dirt from the road surface. Many of the road edges were thin and deteriorated and were also removed in this process. There were a number of bumps in the road which were underlying rocks being moved by frost action. Most of these rocks were excavated and the holes filled with gravel. Some of the bumps were caused by ledge outcroppings, and they also were removed. These broken and excavated areas were temporarily patched and allowed to settle. In the summer a grader was again used to level Class I asphalt into the large depression areas in the roads. This process was followed by hand patching with Class I asphalt in depressions, ruts, potholes, and shoulders not previously

patched. A one-ton roller was used in all cases to compact the asphalt.

Another preparation process was used on a 2482 feet section of Dug-Way-Bridge Road and a 1848 feet section of Liberty Lane. These sections of road were found to be extremely rough prior to preparation. The process used was honing or mix-in-place job. It involves distributing 0.30 gallons of MC-800 cutback asphalt on the existing surface, spreading 70 pounds per square yard of sand chips into the asphalt, and covering the sand chips with another 0.20 gallons per square yard of MC-800. The materials are placed in wind-rows by a grader, mixed thoroughly, and bladed into place as a leveling course. A light coat of sand is spread over the new surface to limit tracking. A pneumatic roller was used to compact the sections (particularly the edges) two days after placement. Traffic also provides for much of the compaction. Honing was completed on July 1, 1981 for Dug-Way-Bridge Road and on July 6, 1981 for Liberty Lane. Minor areas that may have pulled apart were patched with Class I asphalt at a later date.

Just prior to the stone sealing, the road was swept clean of all debris by a power sweeper. All surfaces were well patched and swept before sealing.

Actual surface treatment began at 9:00 am on August 24, 1981. Air temperature was 74°F and the weather sunny. Temperature of the RS-2 emulsion was 175°F. By 4:00 pm the project was completed for the day. Skies were cloudy and the temperature had fallen below 70°F. A second distributor was in use and the temperature of the RS-2 emulsion was 150°F.

The asphalt distributors were Etnyre 5200 gallon tankers owned by Ahern Corporation, East Providence, Rhode Island. Each distributor was equipped with a circulator pump, two oil fired heaters, thermometer, measuring stick for gallons in

tank, bitumeter in truck, and tachometers in truck and on rear engine to accurately distribute the emulsion. The height of the bars above the pavement ranged from eight to ten inches depending on the crown of the road. Nozzles were clean and adjusted at 45° to provide an overlapping, even distribution of emulsion.

An Etnyre 12 foot self propelled aggregate spreader was provided by Able Bituminous Contractors, Inc., East Providence, Rhode Island. The spreader was equipped with cut-off plates to reduce the width of spread from twelve feet to one foot in one foot increments. Haul vehicles dumped the stone into the feed hopper from where it was moved by conveyor belts to the spread hopper which was equipped with augers to insure a smooth, even spread.

Other equipment was also provided by Able. The pneumatic roller was an 8 ton Bros. The steel wheeled roller was a Huber Warco 10-14 ton. A John Deere JD-644 was used to load the trucks. Four 14 cubic yard tandem trucks were used to supply the aggregate from the stock pile. All trucks and equipment were in good operating order.

The train of operation consisted of the distributor, followed by the aggregate spreader at no more than 250 feet distance, the haul vehicles, the pneumatic roller (up to 500 feet behind the spreader), and the steel roller (up to 100 feet behind the pneumatic roller). The train of operation always went against traffic to insure the visibility of the distributor operator.

Glen Rock Road was sealed first from Route 138 to the intersection of James Trail (4740 feet) and was covered with the 1/2 inch stone. The western lane was sealed first at a width of twelve feet. After reaching the intersection of James Trail the operation was turned around to cover the eastern lane. Since the road width

was variable, adjustments were made as necessary to the spray bars to prevent overspray. Ideally the lap between lanes was to be kept to a maximum of six inches, but this was not always possible. The process of sealing one lane and then the opposite lane was done throughout the project.

After distributing over the first 3680 feet by 12 feet (4907 square yards), a check of the tank showed 1800 gallons had been used. This yields a rate of 0.367 gallons per square yard of emulsion compared to the design rate of 0.350 gallons per square yard. A total of 200 tons of 1/2 inch stone was used on the 4740 feet by 23 feet (12,113 square yards) of Glen Rock Road. This is a spread rate of over 33 pounds per square yard of stone compared with the design rate of 28 pounds per square yard. This section of road was completed by 12:30 pm.

During the afternoon, James Trail and Glen Rock Road (to Dug-Way-Bridge) were completed by 4:00 pm. Distribution rate was changed to 0.30 gallon per square yard and spread rate to 25 pounds per square yard for the duration of the project as planned. Traffic control went according to plan, and traffic was restricted until 6:00 pm. A total of 7100 gallons of RS-2 emulsion were used that day. Early in the evening heavy showers were in the area.

Several facts were noticed during the first day of construction. Stone was spread into the emulsion in all cases before the emulsion broke. Even after rolling, the aggregate was not held firmly in place by the emulsion. A time of approximately two hours was needed for the stone to set sufficiently into the emulsion. Some stones were pulled by hand from the surface approximately one hour after rolling. Although the emulsion had broken around the stone and was black, the emulsion beneath the stone was brown indicating a failure to break completely. Haul vehicles were advised to curtail speed and apply brakes gradu-

ally to prevent premature stripping of the stone. Careful traffic control appeared to be essential to the success of the project. A majority of the road area was shaded by trees which may have inhibited curing time. The emulsion asphalt was observed to sink into many of the Class I asphalt patches. In some areas it appeared as if no emulsion had been distributed over the patched areas, since these areas looked dry. After stone application and compaction, the areas all seemed to hold the aggregate. It will be interesting to see if the aggregate remains in place for the duration of the study.

The following day was rainy and no work was started. An inspection of the previous day's work revealed stripping in an area of Glen Rock Road covered by 1/2 inch stone. Cause of the stripping was believed to be the haul vehicles on the job. It was decided to sweep these areas manually, distribute more emulsion on the areas, and cover them with stone the following day. The rain from the previous evening had no effect on the completed job.

On August 26, 1981 the air temperature was 62^{o}F and rising at 9:00 am with sunny skies. Temperature of the RS-2 emulsion was 165^{o}F. Equipment on the job was the same as two days before except for the haul vehicles. Only two 14 cubic yard tandem trucks were used and one 8 cubic yard truck. One of the tandem vehicles was broke down for two hours in the morning. This caused a slow down in the operation. Care was taken to limit the length of pulls made by the distributor so the train of operation was kept together. The train of operation and methods of operation were the same as two days before. Glen Rock Road was completed from Dug-Way-Bridge to the Exeter town line. Repairs were then made manually to the areas behind catch basins and the stripped areas in Glen Rock Road. The stripped areas were found to be more extensive than first thought and were determined not

feasible to repair at the time. Dug-Way-Bridge Road was then sealed in its entirety. No differences were noted in sealing over the hone job. One section of road that was subject to direct sunlight broke promptly and was the only section of road in the project to break before being covered with aggregate. This has caused no apparent problems. Work was complete by 4:00 pm and traffic was restricted on the final sections completed until 6:00 pm. A total of 6300 gallons of RS-2 emulsion were used on the second day.

On August 27, 1981 at 9:00 am the air temperature was 72°F and rising with mostly sunny skies. Temperature of the RS-2 emulsion was 175°F. Equipment on the job was the same as previous days except for the haul vehicles. Three 14 cubic yard tandems and one 8 cubic yard truck were used. The train of operation and methods of operation were the same as previous days. A 3418 feet section of Liberty Lane from Route 2 east was completed first to enhance traffic flow to a residential area and to lengthen the curing time in that area. Sealing over the hone job produced no problems or differences in material characteristics. The following 3000 feet section of Liberty Lane was treated next leaving a 885 feet section undone. The supplier ran out of oil at this point after using 4900 gallons of RS-2. The supplier also ran short of aggregate while treating this section of road. This forced a delay in completion of the work while the haul vehicle trucked the necessary aggregate from another stock pile six miles from the job. Work for the day was completed by 2:00 pm and traffic restricted until 4:00 pm.

On August 31, 1981 at 9:00 am the air temperature was 65°F and rising with sunny skies. Equipment on the job was the same as the previous days except for the haul vehicles. Three 14 cubic yard tandems were used. The train of operation

and methods of operation were the same as previous days. The final 885 feet of Liberty Lane was completed by 11:00 am. Traffic was again restricted until 1:00 pm. A total of 700 gallons RS-2 emulsion were used on the final day.

Sweeping of all the roads was completed by Town personnel. This work began on September 17, 1981 and lasted for six and a half days using a sweeper and one to four hauling vehicles. There appeared to be a substantial amount of excess stone on all the roads.

Cost

A low bid of $0.870 per square yard was received from Able Bituminous Contractors, Inc., East Providence, Rhode Island. This bid price was for stone sealing using either cutback asphalt or emulsion asphalt and either 1/2 inch stone or 3/8 inch stone is the same. It is anticipated that the cost of treatment using emulsion asphalt will decrease as the use of emulsion becomes more prevalent. At present, the vendor must truck the emulsion in from Massachusetts while the cutback is readily available in Rhode Island. If an increase in usage occurs, the vendor will be forced to install storage tanks for emulsion to lower trucking costs. This should in time lower the cost to the customer. The vendor also claims that since more emulsion asphalt is used in sealing than cutback asphalt, any cost savings in production are lost in volume of usage.

Energy Consumption

Appendix C gives supporting evidence as to the total energy required to produce, transport, distribute, and cover liquid emulsion asphalt as opposed to liquid cutback asphalt. Total Energy for emulsion was 169.798 x 10^6 BTU while Total Energy for cutback was 1,007.237 x 10^6 BTU. In equivalent gallons of gasoline

these total energy figures would be 1,358.4 gallons for emulsion and 8,057.9 gallons for cutback. This means a 83.1% savings in total energy by using emulsion rather than cutback. Another figure found was 2,280 gallons of petroleum distillate was saved on the project by using emulsion asphalt. Energy per square yard of emulsion was found to be 2,819.3 BTU/SY or 0.023 gallons of gasoline per square yard. Energy per square yard of cutback was found to be 16,724.3 BTU/SY or 0.134 gallons of gasoline per square yard. All computations were based on the assumption that gallons distributed, tons of aggregate, and methods of operation would be the same using either emulsion or cutback.

Environmental Considerations

At present Rhode Island has no regulations on the use of cutback asphalts because of a low volume of usage in the state. Both neighboring states of Connecticut and Massachusetts do have regulations limiting the emission of hydrocarbons from distributed asphalt. Another method being used to meet the lower standards in these states is to use AC asphalt. This is a cutback asphalt which has lower emissions.

No air quality tests are taken in this part of the state because of the rural characteristics and generally clean air in the area. Therefore, air quality was not a consideration in this project.

A temperature difference of approximately 200^{o}F is found between the application temperatures of cutback and emulsion. The lower distribution temperature of the emulsion produces less vapor and thus fewer emissions.

Conclusions

Three months after completion of the project, the results documented by photo-

graphs and Pavement Rating Forms seem to be satisfactory. End results produced seem to be quite similar to those achieved with cutback asphalts. The only exception to this similarity is the areas that have stripped out in Glen Rock Road. An 850 feet section 1480 feet south of James Trail and proceeding west has stripped over the entire width of the road. The stripping also occurs in small scattered areas of the project, but are not considered numerous or serious. First thoughts were that traffic or haul vehicles may have stripped the area. This has been dismissed because the entire width of the section has stripped and other sections subjected to the same traffic are acceptable. Other ideas of dirty aggregate or faulty emulsion have been dismissed, since the section was completed in two passes. Aggregate supplied to the area was out of the same stockpile yet out of different vehicles. Emulsion supplied was from the same distributor that supplied contiguous sections. The only theories holding any possibility are that the area was extensively patched and very shaded. This combination may have produced a situation where the emulsion was absorbed by the underlying patch and/or the emulsion did not cure as it did in other areas.

Total emulsion usage for the project was 19,000 gallons. Allowing 0.367 gallons per square yard for the area sealed with 1/2 inch stone, the average distribution over the rest of the project was 0.303 gallons per square yard. Approximately 660 tons of 3/8 inch stone was used on the project yielding a spread rate of 27.44 pounds per square yard. It is felt that the distribution rate should be increased to 0.330 gallons per square yard. The spread rate should be reduced to 23 pounds per square yard. Both of these factors apply to the 3/8 inch stone application. For the 1/2 inch stone process the emulsion distribution should be increased to 0.37 gallons per square yard, and the aggregate spread reduced to

25 pounds per square yard. These thoughts are based on observation of the project while in progress and the excess stone removed from the roads by the sweeper. Additional readings on the subject also had a bearing on the adjustments.

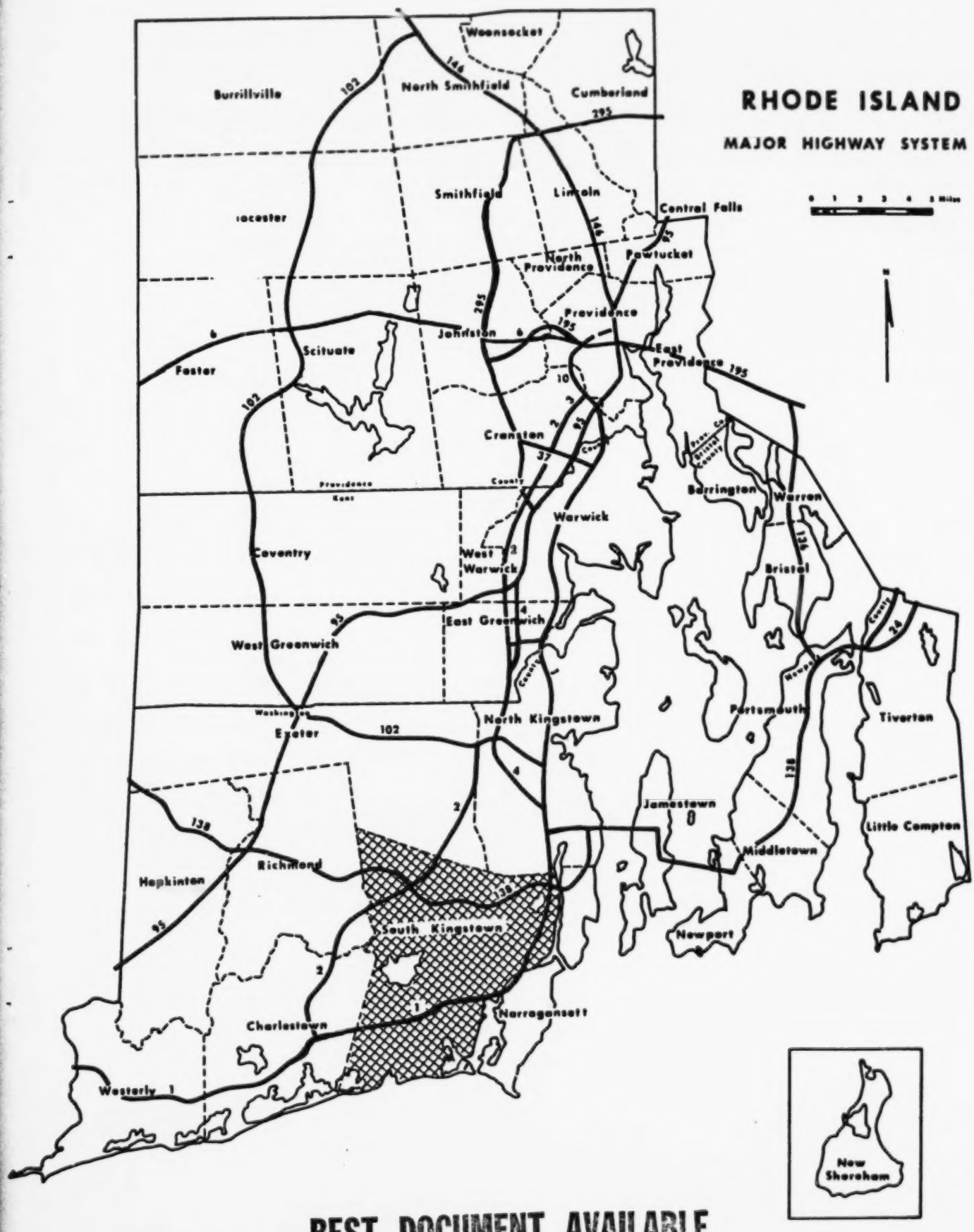
Although the first reaction to the resultant product is positive, final judgement of the project should be reserved until the completion of the three year trial period. Winter freeze thaw cycles can be severe in this area causing tremendous strain on pavement surfaces. This strain very often results in cracks opening during the winter and spring. These cracks may tighten in the summer, but eventually grow wider with succeeding winters. The cracking does occur with cutback asphalt so it is expected with emulsion asphalt as well.

The purpose of this project was to seal all cracks, add a wearing surface to the road, and improve skid resistance of the surface. If the emulsion obtains these goals only as well as cutback, the project should be deemed a success. It was also intended that this project be used to familiarize the Town with the use of emulsion asphalt. This has been accomplished. Although there are peculiarities with the emulsion as opposed to cutback, these differences can be accepted and the product successfully used.

APPENDIX A

MAPS

STATE A-1
TOWN A-2
AREA A-3



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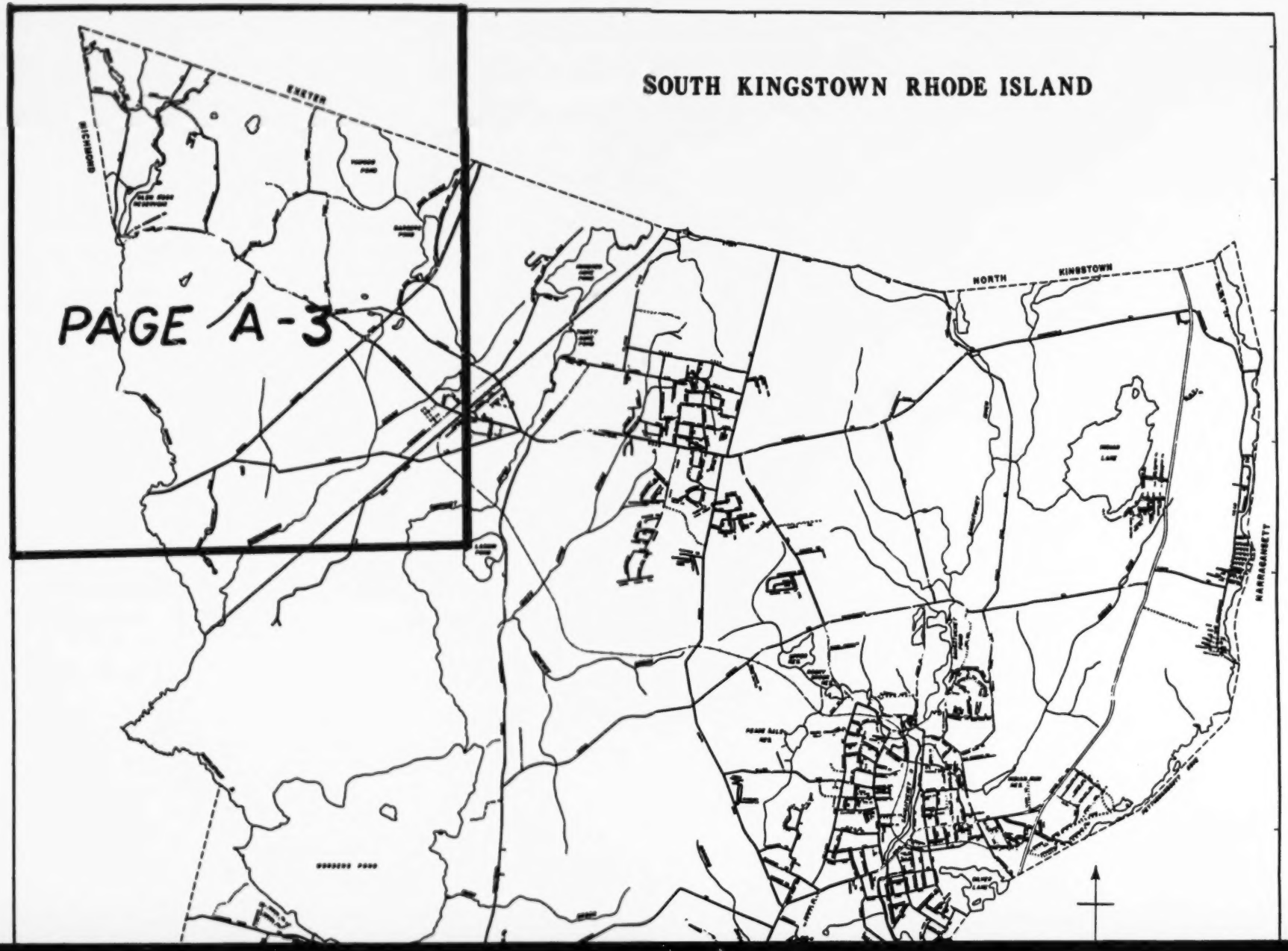

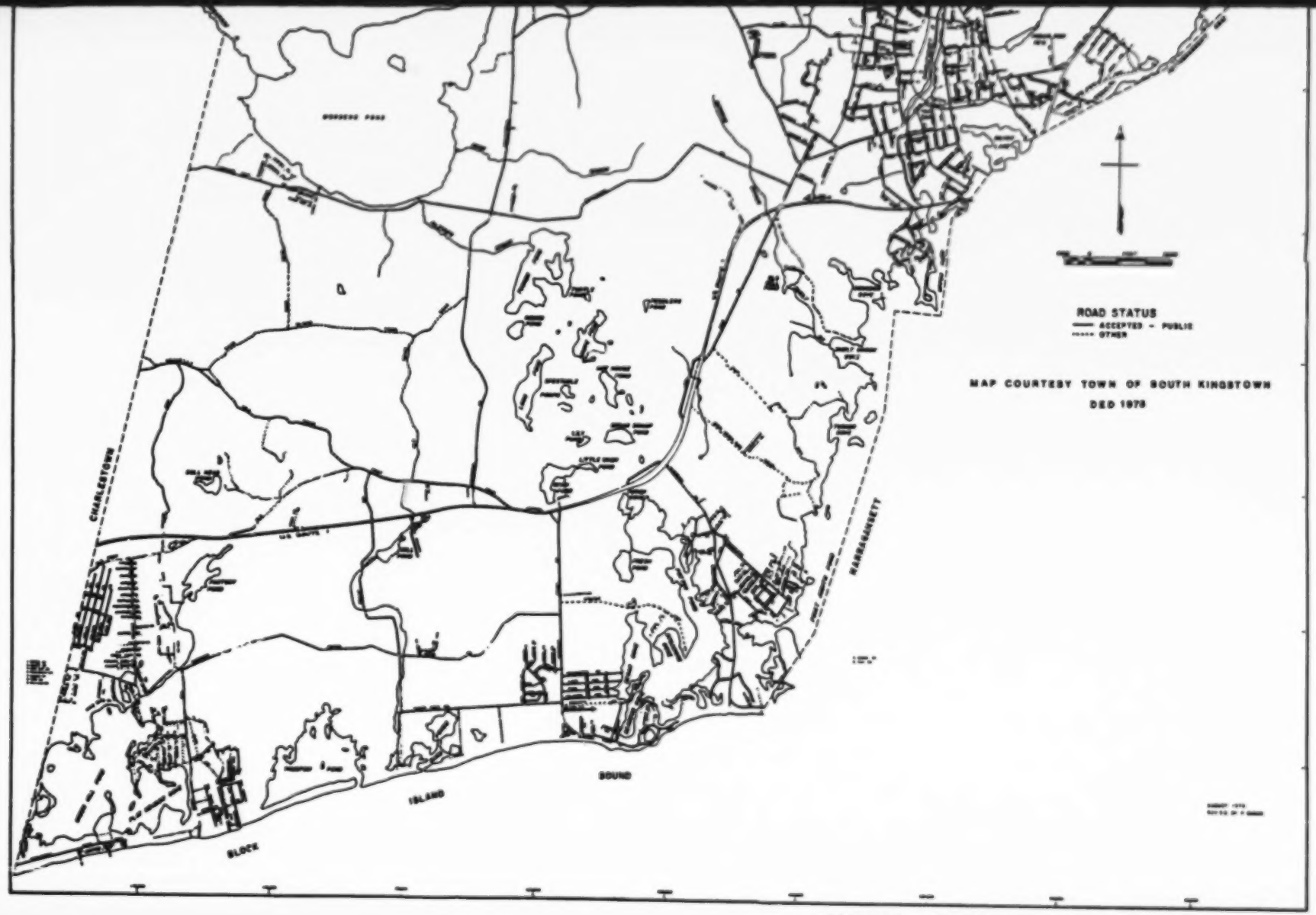

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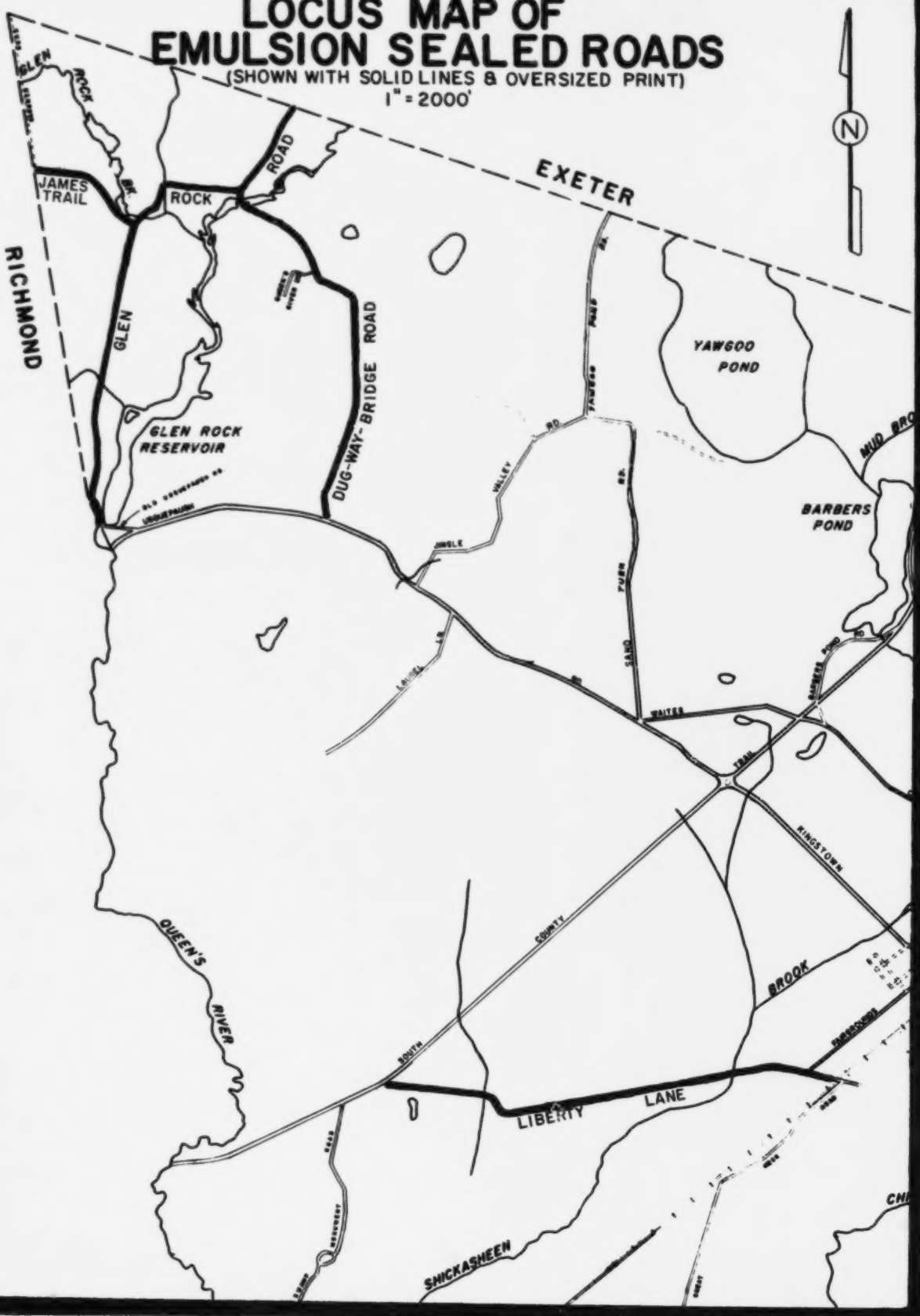
LOCUS MAP OF EMULSION SEALED ROADS

(SHOWN WITH SOLID LINES & OVERSIZED PRINT)

1" = 2000'



APPENDIX B

ROAD OILING CONTRACT

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Bidder's Name Ahern-Able Co., Inc. Bid No. _____

Address 466 Forbes Street, Providence, RI 02915

Price _____

SUPPLEMENT TO BID SPECIFICATIONS

TOWN OF SOUTH KINGSTOWN, RHODE ISLAND

Sealed proposals will be received by Mr. Stephen A. Alfred, Town Manager, until Tuesday, June 9, 1981 at 3:15 P.M. for furnishing the Town of South Kingstown ROAD OIL & SERVICE in accordance with the following specifications and information.

GENERAL INFORMATION

1. The Town of South Kingstown plans to buy ROAD OIL & SERVICE as indicated in the attached specifications.

   Bidder is not to separate the supplement from the proposal form but must return same complete.

   Bid is not to include any taxes from which the Town of South Kingstown is exempted by law, the Town will complete tax exemption forms required by the successful bidder.

2. BID RECEIVED: Proposal shall be made on the form attached and be delivered to the Town Manager on or before 3:15 P.M. on Tuesday, June 9, 1981 in a sealed envelope marked SEALED BID - ROAD OIL & SERVICE and addressed to Mr. Stephen A. Alfred, Town Manager, Town of South Kingstown, Town Hall, 66 High Street, Wakefield, Rhode Island, 02879. Bids will be publicly opened and read at 3:15 P.M. on June 9, 1981 in the office of the Town Manager.

3. BID SECURITY: Bid bonds shall be submitted in the form of a certified check amounting to _____ of the total bid price. All checks will be returned upon acceptance or rejection of bid; however, the successful bidder shall first supply a surety bond on surety company licensed to write surety bonds in the State of Rhode Island in the amount of 100% of the bid price. Said bond shall be surety that the principal shall meet all terms of the contract concerning labor, material, delivery and the payment of any obligations of the principal which the Town might become liable for upon default of the principal.

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4. BID QUALIFICATION: Each bidder shall present evidence that he is normally engaged in the purveying of the type of equipment bid on. The bidder shall make himself thoroughly familiar with the contents of the notice before submitting his proposal; the bidder automatically acknowledges and accepts all the provisions, conditions, and specifications of this notice; no bid shall be considered from bidders who are unable to show that they are normally engaged in the purveying of the type of equipment bid on.

5. DELIVERY: Equipment shall be delivered and installed and ready for operation on or before As per specifications . If the vendor fails to deliver or install the equipment as required in the time indicated or subsequently agreed to, a credit may be taken in the bid price of 1/10 of 1% per day at the discretion of the Town Manager of the Town of South Kingstown.

6. ACCEPTANCE OR REJECTION: The Town of South Kingstown reserves the right to reject any or all proposals, to accept any bid or to waive any informality in the proposal as deemed advisable in the best interest of the Town.

7. The Town agrees to pay for the equipment within 30 days after acceptance. Acceptance means 100% delivery of satisfactory merchandise to comply with our specifications.

8. SUPPLEMENTAL INFORMATION: The bidder must submit with his bid detailed specifications, circulars and all necessary details on the equipment he proposes to furnish in order that the Town may have full information available to it when analyzing the bids.

9. EXCEPTIONS TO SPECIFICATIONS: If the equipment offered differs from the provisions contained in this specification, such differences must be explained in detail on sheets attached to proposal, and if such deviations do not depart from the intent of this notice and are in the best interest of the Town, the proposal will receive careful consideration.

10. TESTS: Before approval the Town Manager or his Agent shall have the right to inspect and test the equipment furnished in accordance with this notice.

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ALTERNATE "A"

SPECIFICATIONS FOR LIQUID BITUMINOUS SURFACE TREATMENT WITH SAND CHIP COVER
FULL CONTRACTUAL SERVICE

LIQUID BITUMINOUS SURFACE TREATMENT

(A) DESCRIPTION:

This work shall consist of furnishing and applying bituminous material with sand chip cover on properly prepared bituminous wearing surfaces of streets as directed.

(B) MATERIALS:

(1) Bituminous Materials:
The grade or grades of bitumen and application rate shall be as specified in the Bid Item and conforming to State of Rhode Island, Department of Public Works specifications.

(2) Aggregate:
A product resulting from screening and/or washing of gravel or sand of uniform quality, free from dust and foreign matter and conforming to State of Rhode Island, Department of Public Works specifications.

(C) QUANTITIES OF MATERIAL PER SQUARE YARD:

Shall be within the maximum and minimum quantities as shown in the Bid Item. The exact quantities of materials may be varied as directed to meet specific field conditions without adjustments to contract unit prices.

(D) EQUIPMENT:

(1) SELF-PROPELLED AGGREGATE SPREADER:

Shall be such to be adjusted to control and spread accurately the given amounts of cover aggregate per square yard. It shall be mounted on pneumatic tires and with a width of spread not less than twelve (12') feet. Cut-off plates shall be provided to permit the width of spread to be reduced in increments of six inches (6") and/or one foot (1') from the maximum width of twelve feet (12') to one foot (1'). The unit shall be capable of spreading aggregate of maximum one and one half inch (1½") size at any rate desired from 10 to 50 lbs. per square yard of surface covered without contact of the wheels of the spreader with the treated surface until the aggregate has been spread. A hopper of minimum capacity of five (5) tons, integral with the spreader unit, shall be provided to receive the aggregate from transporting vehicles, without the wheels of such vehicles coming in contact with the uncovered bitumen road surface. Two conveyor belts shall distribute the aggregate from feed hopper to the spread hopper which shall have augers and/or agitators to distribute aggregate uniformly to road surface. Power shall be provided to propel the spreader at a uniform rate of movement on gradients up to 6%.

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(2) SELF-PROPELLED RUBBER TIRED ROLLER:

Shall be suitable for rolling bituminous pavements and shall have a total compacting width of not less than sixty inches (60"). The gross weight and operating weight shall be as directed.

(3) DISTRIBUTOR:

Shall contain suitable mechanical circulating and heating appliances which will provide a uniform approved temperature of the entire mass of the material. It shall be capable of applying bituminous materials in accurately measured quantities at any rate from 1/10 to 2 gallons per square yard of surface with any width of moveable spray bar ordered to a maximum of 20 feet, and maintaining a uniform rate of distribution for the entire load regardless of change of gradient or direction of the road. The design and size of spray nozzles and construction of the pressure system shall provide a sufficient and uniform fan-shaped spray throughout the entire length of moveable spray bar at all times while operating, which spray will uniformly and completely cover the portion of surface receiving the application. Each distributor shall be equipped with the following: two (2) tachometers, one in the truck to show feet per minute, and the second at the rear motor to show gallons per minute; a thermometer, a measuring stick graduated in gallons, and a strainer in the discharge lines to prevent clogging.

(4) OTHER EQUIPMENT:

Namely, trucks in sufficient number to supply the spreader, and broom drags for additional cover uniformity.

(E) LIQUID BITUMINOUS SURFACE TREATMENT CONSTRUCTION METHODS:

(1) MEASUREMENTS:

The contractor and a representative of the town shall measure all streets identifying the location, dimensions, square yards of work areas involved and the cost for same.

(2) WEATHER LIMITATIONS:

The surface treatment shall be applied only when the road surface is dry, and not when weather is foggy or rainy. The treatment shall not be applied when the atmospheric temperature is below 40 degrees F. unless other wise directed.

(3) APPLICATION OF BITUMINOUS MATERIALS:

Immediately following the preparation of the road surfaces, the bituminous material shall be applied at the rates specified in the Bid Item and at the temperatures as directed.

(4) SPREADING AGGREGATE:

The covering material in the quantity specified in the Bid Item shall be spread uniformly over the bituminous material immediately after

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liquid application. Before the bituminous material is applied, sufficient aggregate to cover must be loaded on trucks at the site of the work. NO BITUMINOUS MATERIAL SHALL BE DOWN MORE THAN 15 MINUTES BEFORE IT IS COVERED WITH AGGREGATE. Spreading shall be done uniformly with self-propelled spreader.

(5) BROOM DRAGGING:

A broom-drag, approved by the town shall be used to further insure aggregate cover.

(6) ROLLING:

Rolling shall be done with self-propelled pneumatic rubber tired roller following the broom dragging. The roller shall be operated at a speed that will not displace the aggregate cover.

BASIS FOR PAYMENT:

Payment for Bid Item shall be made at the contract unit price per square yard times the predetermined number of square yards contained in each street. The prices per square yard shall be full compensation for furnishing all materials, equipment, tools, and incidentals necessary to successfully complete the surface treatment as hereinbefore described.

Note: Included in this cost per sq.yd., is a Working Foreman to be supplied by the vendor. This Foreman will be under the direction of the Public Works Supervisor and his services will be controlled solely by the Supervisor. This Foreman's duties may include but not be limited to directing the preparation of road surfaces, supervising the ordering and distribution of the oil, supervising the daily activities of the sealing program, supervising the road honing program, and operating the grader on the honing program. The Foreman will be available to the Town at no cost through the entire program.

BID ITEM:

a. Quantites and grade of bitumen; .25 to .30 gallons per square yard of MC-800.

b. Sand chip in accordance with specifications at a rate of 25 to 30 lbs. per square yard.

c. Remainder of work in accordance with specifications.

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ALTERNATE B

SPECIFICATIONS FOR LIQUID BITUMINOUS SURFACE TREATMENT WITH COVER STONE
FULL CONTRACTUAL SERVICE

LIQUID BITUMINOUS SURFACE TREATMENT

(A) DESCRIPTION:

This work shall consist of furnishing and applying bituminous material with coverstone on properly prepared bituminous wearing surfaces of streets as directed.

(B) MATERIALS:

(1) Bituminous Materials:
The grade or grades of bitumen and application rate shall be as specified in the Bid Item and conforming to State of Rhode Island, Department of Public Work specifications.

(2) Aggregate:
A clean, hard durable stone consisting of 100% crushed particles. The materials shall have a maximum percentage of wear of not more than that determined by AASHO T 96 (Los Angeles Abrasion Test). It shall be graded to meet the following requirements:

Sieve Size	Gradation - % Passing
3/4"	100
1/2"	90-100
3/8"	30-60
#4	0-15
#8	0-5

The above aggregate materials shall have a maximum percentage loss of 12% (i.e. AASHA T 104) and a maximum percentage of wear of 30. Stone shall be treated in a mix plant or pugmill at a rate of two (2) to three (3) gallons per ton using cutback asphalt MC-30 or MC-70, or asphalt emulsion CSS-1H. Sufficient stone shall be treated and stock piled on location for entire project.

(C) QUANTITIES OF MATERIALS PER SQUARE YARD:

Shall be within the maximum and minimum quantities as shown in the Bid Item. The exact quantities of materials may be varied as directed to meet specific field conditions without adjustments to contract unit prices.

(D) EQUIPMENT:

(1) SELF-PROPELLED AGGREGATE SPREADER:

Shall be such to be adjusted to control and spread accurately the given amount of cover aggregate per square yard. It shall be mounted on pneumatic tires and with a width of spread not less than twelve feet (12). Cut-off plates shall be provided to permit the width of spread to be reduced in increments of six inches (6") and/or one foot (1') from the maximum width of twelve feet (12') to one foot (1'). The unit shall be capable of spreading aggregate of maximum one and one half inch (1½") size at any rate desired from 10 to 50 lbs. per square yard of surface covered without contact of the wheels of the spreader with the treated surface until the aggregate has been spread. A hopper

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of minimum capacity of five (5) tons, integral with the spreader unit, shall be provided to receive the aggregate from transporting vehicles, without the wheels of such vehicles coming in contact with the uncovered bitumen road surface. Two conveyor belts shall distribute the aggregate from feed hopper to the spread hopper which shall have augers and/or agitators to distribute aggregate uniformly to road surface. Power shall be provided to propel the spreader at a uniform rate of movement on gradients up to 6%.

(2) SELF-PROPELLED RUBBER TIRED ROLLER:

Shall be suitable for rolling bituminous pavements and shall have a total compacting width of not less than sixty (60) inches. The gross weight shall be adjustable within the ranges of two hundred (200) to three hundred (300) pounds per inch of compacting width. The operating weight shall be as directed.

(3) STEEL WHEEL ROLLER:

Two (2) wheel steel drums with an eight (8) to ten (10) ton maximum capacity.

(4) DISTRIBUTOR:

Shall contain suitable mechanical circulating and heating appliances which will provide a uniform approved temperature of the entire mass of the material. It shall be capable of applying bituminous materials in accurately measured quantities at any rate from 1/10 to 2 gallons per square yard of surface with any width of moveable spray bar ordered to a maximum of 20 feet, and maintaining a uniform rate of distribution for the entire load regardless of change of gradient or direction of the road. The design and size of spray nozzles and construction of the pressure system shall provide a sufficient and uniform fan-shaped spray throughout the entire length of moveable spray bar at all times while operating, which spray will uniformly and completely cover the portion of surface receiving the application. Each distributor shall be equipped with the following: two (2) tachometers, one in the truck to show feet per minute, and the second at the rear motor to show gallons per minute, a thermometer, a measuring stick graduated in gallons, and a strainer in the discharge lines to prevent clogging. Also attached hand gun and hose, a pouring pot and a squeegee.

(5) FRONT END LOADER:

Minimum three (3) cubic yard rubber-tired front-end loader to load stone on trucks at stockpile.

(6) TRUCKS:

Trucks in sufficient number to supply the chipspreader at all times.

(E) LIQUID BITUMINOUS SURFACE TREATMENT CONSTRUCTION METHODS:

(1) MEASUREMENTS:

The contractor and a representative of the town shall measure all streets identifying the location, dimensions, square yards of work areas involved and the cost for same.

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(2) WEATHER LIMITATIONS:

The surface treatment shall be applied only when the road surface is dry and not when weather is foggy or rainy. The treatment shall not be applied when the atmospheric temperature is below 40 degrees F. unless otherwise directed.

(3) APPLICATION OF BITUMINOUS MATERIALS:

Immediately following the preparation of the road surfaces, the bituminous materials shall be applied at the rates specified in the Bid Item and at the temperatures as directed.

(4) SPREADING AGGREGATE:

The covering material in the quantity specified in the Bid Item shall be spread uniformly over the bituminous material immediately after liquid application. Before the bituminous material is applied, sufficient aggregate to cover must be loaded on trucks at the site of the work. NO BITUMINOUS MATERIAL SHALL BE DOWN MORE THAN 15 MINUTES BEFORE IT IS COVERED WITH AGGREGATE. Spreading shall be done uniformly with self propelled spreader. Trucks spreading aggregate shall be operated backwards covering the bituminous material ahead of the truck wheels.

(5) ROLLING:

Initial rolling shall be done with a self-propelled pneumatic roller immediately following the application of the cover aggregate. The rollers shall be operated at a speed that will not displace the aggregate. A steel wheel roller, not to exceed in weight the eight (8) to ten (10) model, shall follow behind the pneumatic roller. This additional rolling is provided as an option to the Awarding Authority at no additional cost.

BASIS FOR PAYMENT:

Payment for Bid Item shall be made at the contract unit price per square yard times the predetermined number of square yards contained in each street. The prices per square yard shall be full compensation for furnishing all materials, equipment, tools and incidentals necessary to successfully complete the surface treatment as hereinbefore described.

NOTE: Included in this cost per sq.yd., is a Working Foreman to be supplied by the vendor. This Foreman will be under the direction of the Public Works Supervisor and his services will be controlled solely by the Supervisor. This Foreman's duties may include but not be limited to directing the preparation of road surfaces, supervising the ordering and distribution of the oil, supervising the daily activities of the sealing program, supervising the road honing program, and operating the grader on the honing program. The Foreman will be available to the Town at no cost through the entire program.

BID ITEM:

a. Quantities and grade of bitumen; .25 to .35 gallons per sq. yd. of MC-3000
b. Cover stone in accordance with specifications at a rate of 30 lbs. per square yard.
c. Remainder of work in accordance with specifications.

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ALTERNATE C

ROAD OIL BID SPECIFICATIONS

PARTIAL CONTRACTUAL SERVICE

Sealed bids to supply the Town of South Kingstown with gallons, more or less of all types of road oil, delivered in a two (2) man operated truck to destination and applied, if and when ordered under the following conditions:

Distributors shall be equipped with a constant air pressure device or separate pump and motor for maintaining constant pressure of application. Distributors shall be operated on pneumatic tires. Distributors with heating systems of the direct type shall be equipped with an efficient circulating system, so arranged that the bituminous material can be pumped or moved mechanically from the hot end of the tank to the cold end, and so agitated that the temperature will be uniform throughout the tank. The use of air to agitate the material, or the use of free steam to agitate or heat the material is prohibited. Bituminous material shall be applied at a pressure of twenty (20) to seventy-five (75) pounds per square inch. The distributor shall be equipped with an accurate thermometer to show the temperature of the bituminous material. An accurate pressure gauge shall be installed on the pump line to show pressure of application. The distributor shall be equipped with manufacturer's calibration of the tank in U.S. gallons. A Tachometer shall be provided on the truck so located that it is readily visible to the truck driver or other satisfactory method provided to insure uniform distribution on varying grades. Nozzles shall be so designed to give a uniform spray with sufficient pressure to apply the specified quantities of material uniformly from the entire length of the spray bar, which bars shall be of a length required by the Engineer. The distributor shall be equipped with suitable hand spray nozzles and flexible hose connections for applying bituminous materials at intersections and to irregular width areas.

No equipment will be approved that is obviously obsolete in design or which is mounted on motor trucks or trailers in poor repair or which fails to give satisfactory results. Complete control of distributors by tail end man must be maintained. Also, the right of the Engineer to reject, at no cost to the Town, the ordered bituminous material should the equipment sent to apply same be in improper working order.

APPLICATION OF BITUMINOUS MATERIAL

Bituminous material shall be applied by means of a pressure distributor at the rate or rates indicated by the Engineer, and at the temperature stated for the particular material being used. Any prescribed application may be divided into two applications to prevent flowing off the surface and additional bituminous material may be ordered applied where surface conditions indicate it to be necessary if the Engineer so directs.

The application of the bituminous material shall be as required for the particular type of work in which the bituminous material is being used and any special requirements therein given for the application of bituminous material shall be observed.

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ROAD OIL BID SPECIFICATIONS

The surfaces of structures, such as concrete pavement, curbing edging, etc. and trees, shrubs, etc. adjacent to the area being treated shall be protected by suitable paper covering or other approved methods in such manner as to prevent their being spattered or marred. Bituminous material shall not be discharged into borrow pits or gutters.

METHODS OF MEASUREMENT

The gallonage of bituminous material to be paid for shall be the number of gallons of bituminous material furnished and used as ordered. The unit of measurement for bituminous material shall be the gallon. Gallonage shall be determined by measuring the material at a temperature of sixty (60) degrees Fahrenheit, or by converting the gallonage measured at other temperatures to gallonage at sixty (60) degrees Fahrenheit in accordance with A.S.T.M. Designation D 206-36 or its latest revision.

BASIS OF PAYMENT

The quantity of bituminous material, determined as provided in the preceding section, shall be paid for at the contract unit price bid per gallon for "Furnishing, Hauling, Heating and Applying Bituminous Material" (as classified and stipulated on the Plans or in the Proposal) for the designated type or types, grade or grades, of bituminous material, as the case may be, which price and payment shall be full compensation for furnishing, hauling, heating and applying bituminous material as specified.

NOTE: Included in this cost per gallon is a Working Foreman to be supplied by the vendor. This Foreman will be under the direction of the Public Works Supervisor and his services will be controlled solely by the Supervisor. This Foreman's duties may include but not be limited to directing the preparation of road surfaces, supervising the ordering and distribution of the oil, supervising the daily activities of the sealing program, supervising the road honing program, and operating the grader on the honing program. This Foreman will be available to the Town at no cost through the entire program.

Should the supplier not be able to comply with these specifications upon being awarded this bid, bituminous material may be purchased through next low bidder with the difference in cost to be paid by company awarded bid.

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PROPOSAL SHEET

ALTERNATE "A"

Full Contractual Service -- Sand Chip Cover

No Bid per sq. yd. using cutback asphalt

No Bid per sq. yd. using emulsion asphalt

ALTERNATE "B"

Full Contractual Service -- Cover Stone 1.3/8" Stone Seal

No Bid per sq. yd. using cutback asphalt

No Bid per sq. yd. using emulsion asphalt

2.1/2" Stone Seal

No Bid per sq. yd. using cutback asphalt

No Bid per sq. yd. using emulsion asphalt

ALTERNATE "C"

Partial Contractual Service

$1.065 per gallon using cutback asphalt

$ .955 per gallon using emulsion asphalt

Mixing Grade Emulsion $1.00 per gallon

PLEASE NOTE:

In view of the energy crisis, prices are subject to change without notice, either increase or decrease, occurring after the date of this bid and up to and including the date of each delivery.

All material furnished shall comply with State of Rhode Island Department of Public Works specifications.

Bidder Name: AHERN CORPORATION

Address: 466 FORBES STREET
RIVERSIDE, R. I. 02915

By: PHILIP J. HILL
please print

Title: President

Signature of Bidder: Philip J. Hill

Date: June 8, 1981

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PROPOSAL SHEET

ALTERNATE "A"

Full Contractual Service -- Sand Chip Cover

$0.65 per sq. yd. using cutback asphalt

$0.65 per sq. yd. using emulsion asphalt

ALTERNATE "B"

Full Contractual Service -- Cover Stone 1.3/8" Stone Seal: $0.87 per sq. yd. using cutback asphalt

$0.87 per sq. yd. using emulsion asphalt

2.1/2" Stone Seal: $0.87 per sq. yd. using cutback asphalt

$0.87 per sq. yd. using emulsion asphalt

ALTERNATE "C"

Partial Contractual Service

No Bid per gallon using cutback asphalt

No Bid per gallon using emulsion asphalt

Bidder Name: Able Bituminous Contractors, Inc.

Address: 466 Forbes St., Riverside, RI 02915

By: Laura J. Gamble
please print

Title: Secretary

Signature of Bidder: Laura J. Gamble Secretary

Date: June 9, 1981

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APPENDIX C

ENERGY CONSUMPTION

APPENDIX C[1]

Energy Consumption Using Emulsion Asphalt

Manufacture emulsion -

19,000 gal x 2100 BTU/gal = 39.9×10^6 BTU

Fuel consumption -

902 gal diesel x 139,000 BTU/gal = 125.378×10^6 BTU

Electric Power -

not applicable

Heating emulsion -

1 hr/5200 gal RS2 x 19,000 gal RS2 x 8 gal diesel/hr x 139,000 BTU gal =

4.063×10^6 BTU

1 hr/5200 gal RS2 x 19,000 gal RS2 x 1 gal gasoline/hr x 125,000 BTU/gal =

0.457×10^6 BTU

Aggregate drying -

none

Total Energy - 169.798×10^6 BTU

Equivalent gallons of gasoline

169.798×10^6 BTU ÷ 0.125×10^6 BTU/gal gasoline = 1358.4 gal of gasoline

Manufacture asphalt -

19,000 gal x 29,500 BTU/gal = 560.500×10^6 BTU

Fuel consumption -

902 gal diesel x 139,000 BTU/gal = 125.378×10^6 BTU

Electric power -

not applicable

Gallons of petroleum distillates required -

2280 gals x 135,000 BTU/gal = 307.800×10^6 BTU

[1]Figures supplied by Ahern-Able Companies

Heating cutback -

3 hrs/5200 gal MC3000 x 19,000 gal cutback x 8 gal diesel/hr x 139,000 BTU/gal =

12.189×10^6 BTU

3 hrs/5200 gal MC3000 x 19,000 gal cutback x 1 gal gasoline/hr x 125,000 BTU/gal =

1.370×10^6 BTU

Aggregate drying -

none

Total Energy - $1{,}007.237 \times 10^6$ BTU

Equivalent gallons of gasoline

$1{,}007.237 \times 10^6$ BTU ÷ 0.125×10^6 BTU/gal gasoline = 8,057.9 gal. of gasoline

Total Energy to manufacture cutback - Total Energy to manufacture emulsion =

Energy Savings

$1{,}007.237 \times 10^6$ BTU - 169.798×10^6 BTU = 837.439×10^6 BTU

Equivalent gallons of gasoline saved =

8,057.9 gal - 1358.4 gal = 6699.5 gal

Percentage energy savings between emulsion and cutback =

$$\frac{1{,}007.237 \times 10^6 \text{ BTU} - 169.798 \times 10^6 \text{ BTU}}{1{,}007.237 \times 10^6 \text{ BTU}} = 83.1\%$$

BTU per square yard of emulsion = Total Energy ÷ total square yards

169.798×10^6 BTU ÷ 60,226 SY = 2819.3 BTU/SY

Equivalent gallons of gasoline per square yard using emulsion = Equivalent gallons of gasoline ÷ total square yards

1358.4 gal ÷ 60.226 SY = 0.023 gal/SY

BTU per square yard of cutback = Total Energy ÷ total square yards

$1{,}007.237 \times 10^6$ BTU ÷ 60,226 SY = 16,724.3

Equivalent gallons of gasoline per square yard using cutback = Equivalent gallons of gasoline ÷ total square yards

8,057.9 gal ÷ 60,226 SY = 0.134 gal/SY

APPENDIX D

SELECTED PICTURES
AND
PAVEMENT RATING FORMS

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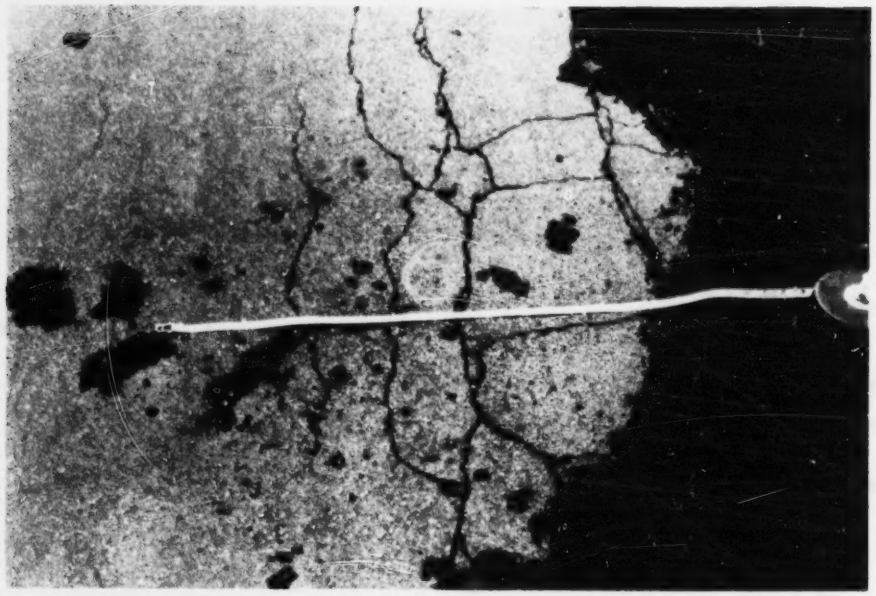
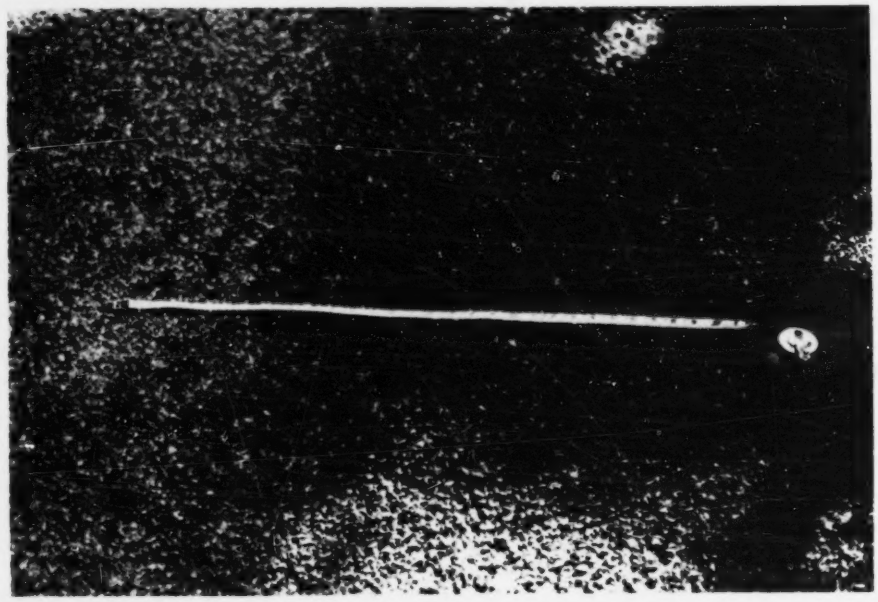
LIBERTY LANE

Location: 4' north of N.E.Co. pole #6756, facing east, straight road on the edge.

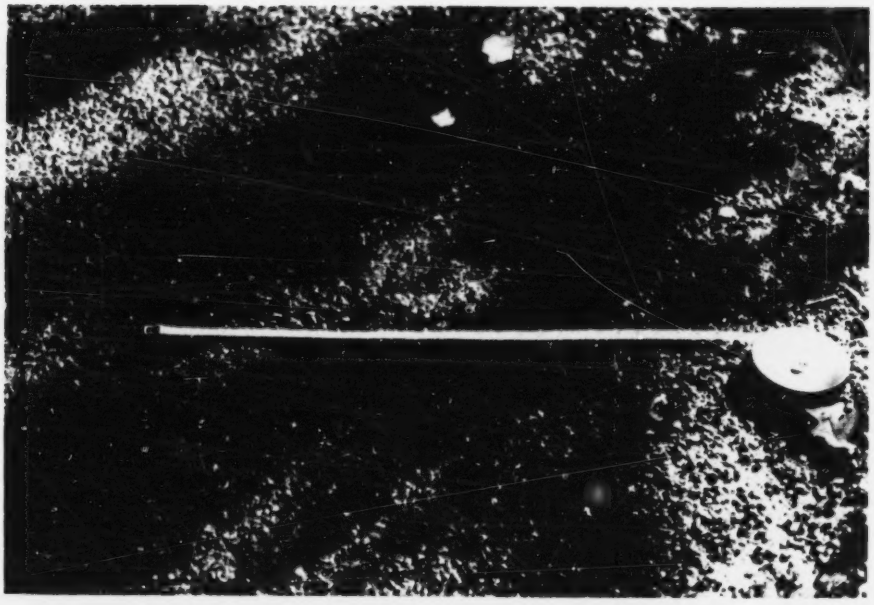


August 5, 1981
Shows patch over broken edges and shrinkage cracking.

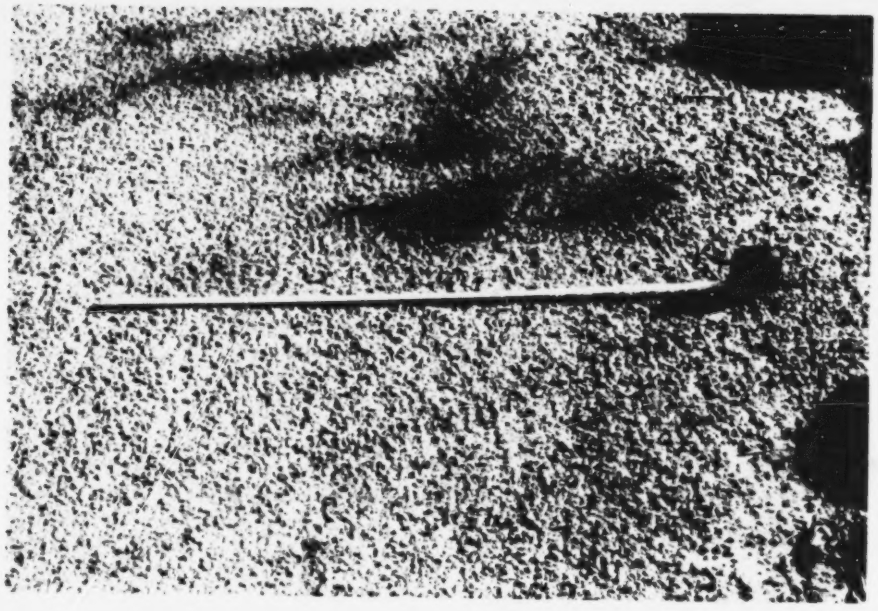


September 10, 1981
Surface well sealed, moderate excess stone on edge of road.

BEST DOCUMENT AVAILABLE



October 9, 1981
Surface well sealed, no excess stone
on edge of road.



November 6, 1981
Surface well sealed except on very
edge of road.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Liberty Lane CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 7250 WIDTH 23

PAVEMENT TYPE Sand Seal DATE 8-5-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	5
Longitudinal Cracks	0-5	3
Alligator Cracks	0-10	5
Shrinkage Cracks	0-5	4
Rutting	0-10	10
Corrugations	0-5	0
Raveling Stripping	0-5	2
Shoving or Pushing	0-10	0
Pot Holes	0-10	8
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	5
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	7
	Sum of Defects	49

Condition Rating = 100 - Sum of Defects

= 100 - 49

Condition Rating = 51

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Liberty Lane CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 7250 WIDTH 23

PAVEMENT TYPE Stone Seal DATE 9-10-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling ..... Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	4
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	9

Condition Rating = 100 - Sum of Defects

= 100 - 9

Condition Rating = 91

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Liberty Lane CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 7250 WIDTH 23

PAVEMENT TYPE Stone Seal DATE 10-9-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	4
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	9

Condition Rating = 100 - Sum of Defects

= 100 - 9

Condition Rating = 91

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Liberty Lane CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 7250 WIDTH 23

PAVEMENT TYPE Stone Seal DATE 11-6-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	4
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	9

Condition Rating = 100 - Sum of Defects

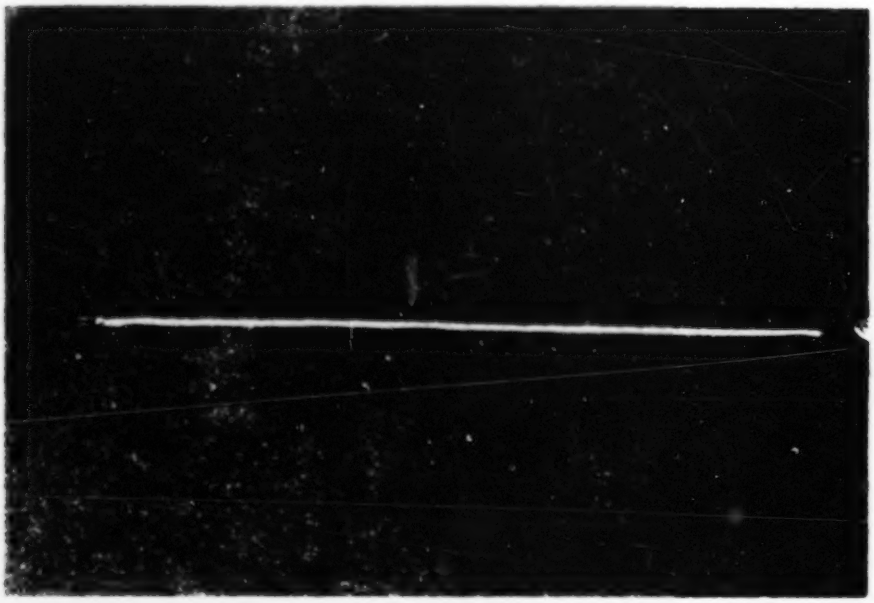
= 100 - 9

Condition Rating = 91

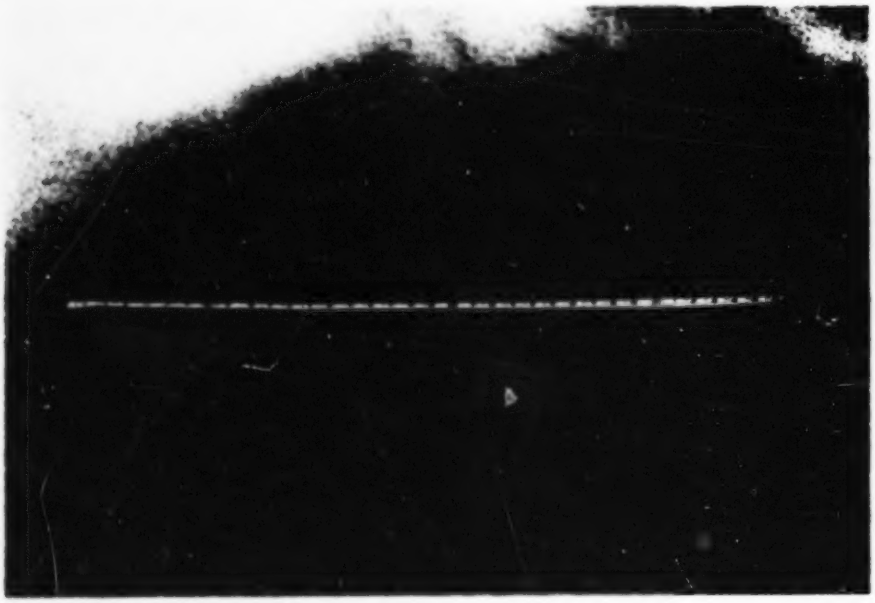
Figure 1. Asphalt pavement rating form.

BEST DOCUMENT AVAILABLE

DUG-WAY-BRIDGE ROAD
Location: 14' east, 31' south of N.E.Tel. pole #34, facing north, near crest of slight grade.



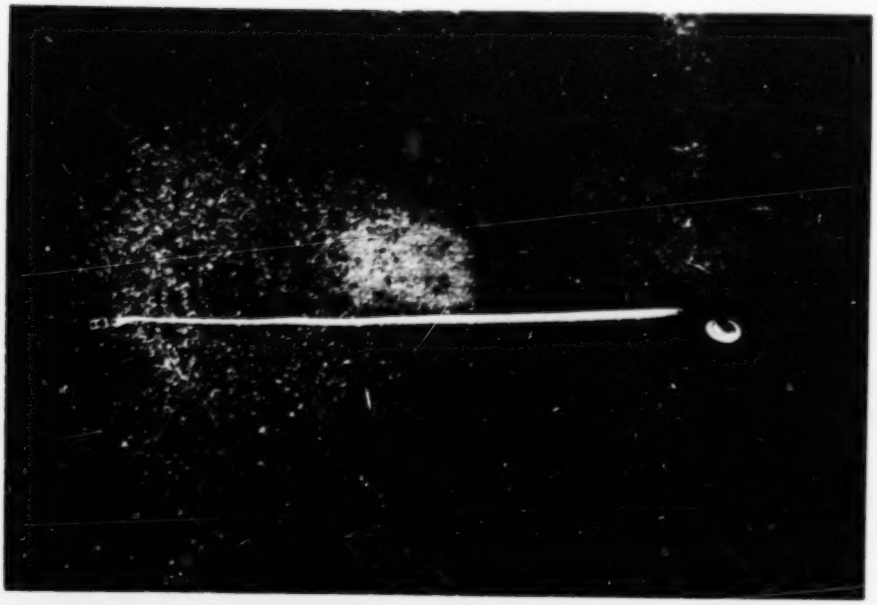
August 5, 1981
Shows longitudinal and transverse cracking.



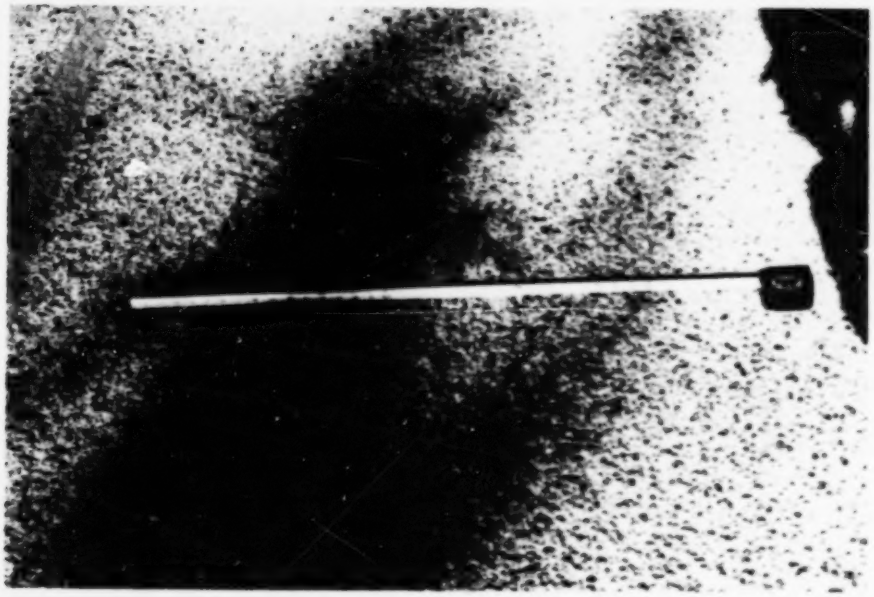
September 10, 1981
Surface well sealed, moderate excess stone on edge of road.

BEST DOCUMENT AVAILABLE

DUG-WAY-BRIDGE ROAD



October 9, 1981
Surface well sealed, no excess stone on road.



November 6, 1981
Surface well sealed.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Dug-Way-Bridge Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 5988 WIDTH 24

PAVEMENT TYPE Sand Seal DATE 8-5-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	4
Longitudinal Cracks	0-5	4
Alligator Cracks	0-10	3
Shrinkage Cracks	0-5	3
Rutting	0-10	7
Corrugations	0-5	0
Raveling Stripping	0-5	3
Shoving or Pushing	0-10	X0
Pot Holes	0-10	4
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	5
	Sum of Defects	36

Condition Rating = 100 - Sum of Defects

= 100 - 36

Condition Rating = 64

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Dog-Way-Bridge Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 5988 WIDTH 24

PAVEMENT TYPE Stone Seal DATE 9-10-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling ... Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	8

Condition Rating = 100 - Sum of Defects

= 100 - 8

Condition Rating = 92

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Dog-Way-Bridge Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 5988 WIDTH 24

PAVEMENT TYPE Stone Seal DATE 10-9-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	8

Condition Rating = 100 - Sum of Defects

= 100 - 8

Condition Rating = 92

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Dug - Way - Bridge Rd CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 5988 WIDTH 24

PAVEMENT TYPE Stone Seal DATE 11-6-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	8

Condition Rating = 100 - Sum of Defects

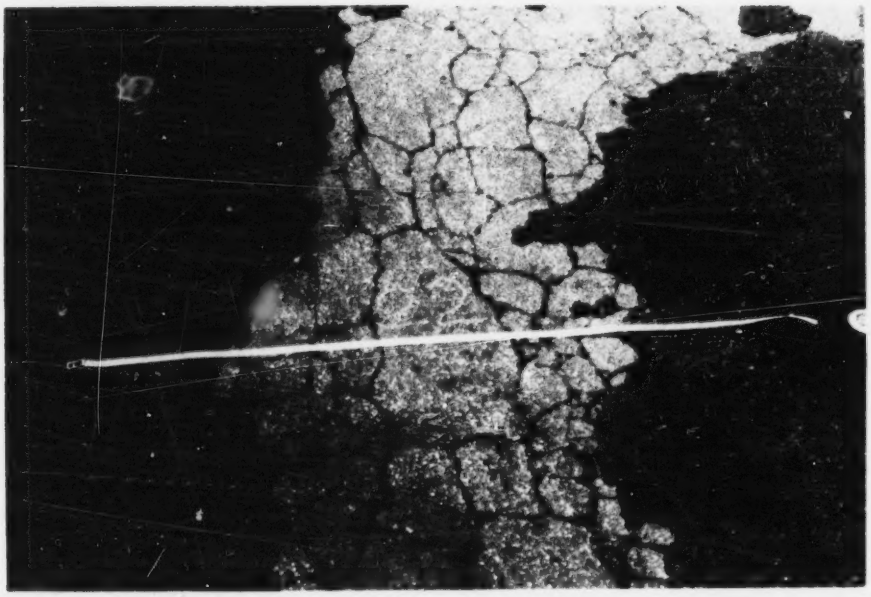
= 100 - 8

Condition Rating = 92

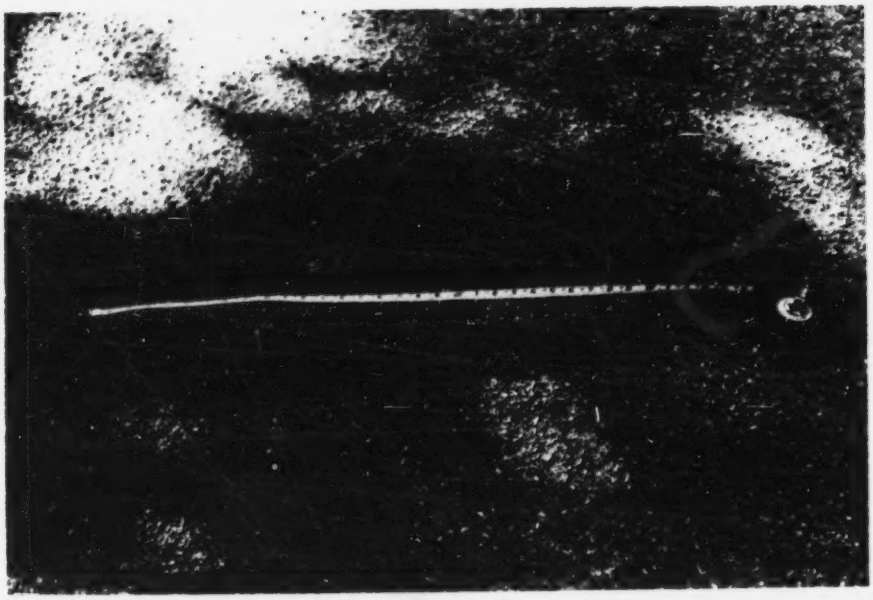
Figure 1. Asphalt pavement rating form.

BEST DOCUMENT AVAILABLE

GLEN ROCK ROAD
Location: 12' east, 38' south of C. Boisclair's mailbox, facing south in center of straight road.



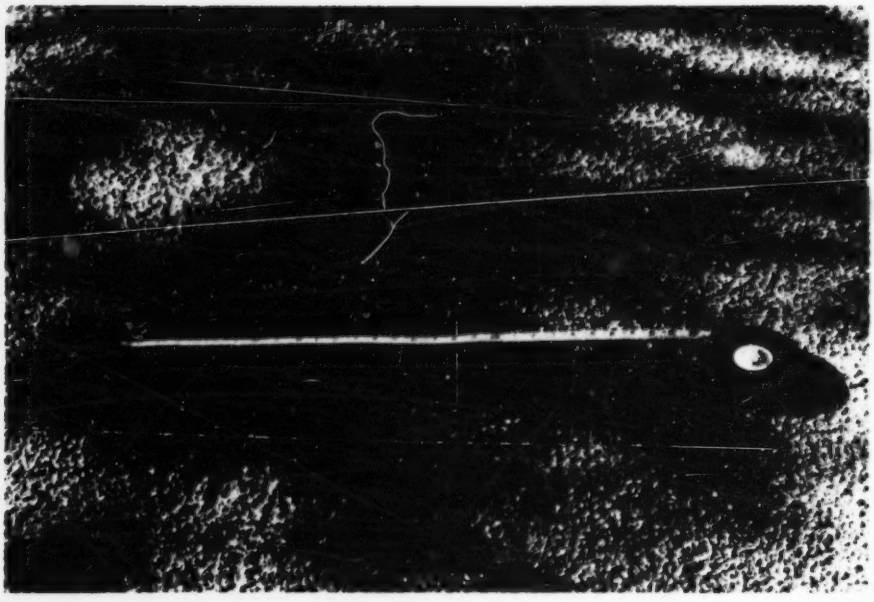
August 5, 1981
Shows alligator cracking and portions of patched areas.



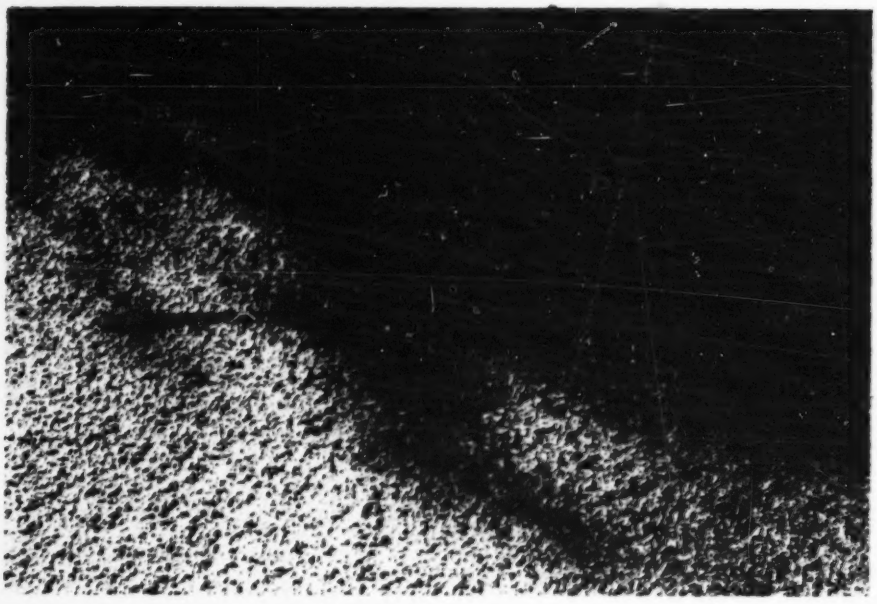
September 10, 1981
Surface well sealed, moderate excess of stone in center of road.

BEST DOCUMENT AVAILABLE

GLEN ROCK ROAD



October 9, 1981
Surface well sealed, no excess stone on road.



November 6, 1981
Surface well sealed.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 8660 WIDTH 23

PAVEMENT TYPE Sand Seal DATE 8-5-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	5
Longitudinal Cracks	0-5	4
Alligator Cracks	0-10	3
Shrinkage Cracks	0-5	5
Rutting	0-10	8
Corrugations	0-5	0
Raveling ....Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	3
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	5
	Sum of Defects	36

Condition Rating = 100 - Sum of Defects

= 100 - 36

Condition Rating = 64

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 3918 WIDTH 23

PAVEMENT TYPE ¾" Stone Seal DATE 9-10-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	3
Corrugations	0-5	0
Raveling - Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	9

Condition Rating = 100 - Sum of Defects

= 100 - 9

Condition Rating = 91

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 3918 WIDTH 23

PAVEMENT TYPE ¾" Stone Seal DATE 10-9-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	3
Corrugations	0-5	0
Raveling ... Stripping	0-5	2
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	10

Condition Rating = 100 - Sum of Defects

= 100 - 10

Condition Rating = 90

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 3918 WIDTH 23

PAVEMENT TYPE 3/8" Stone Seal DATE 11-6-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	3
Corrugations	0-5	0
Raveling Stripping	0-5	2
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	3
	Sum of Defects	10

Condition Rating = 100 - Sum of Defects

= 100 - 10

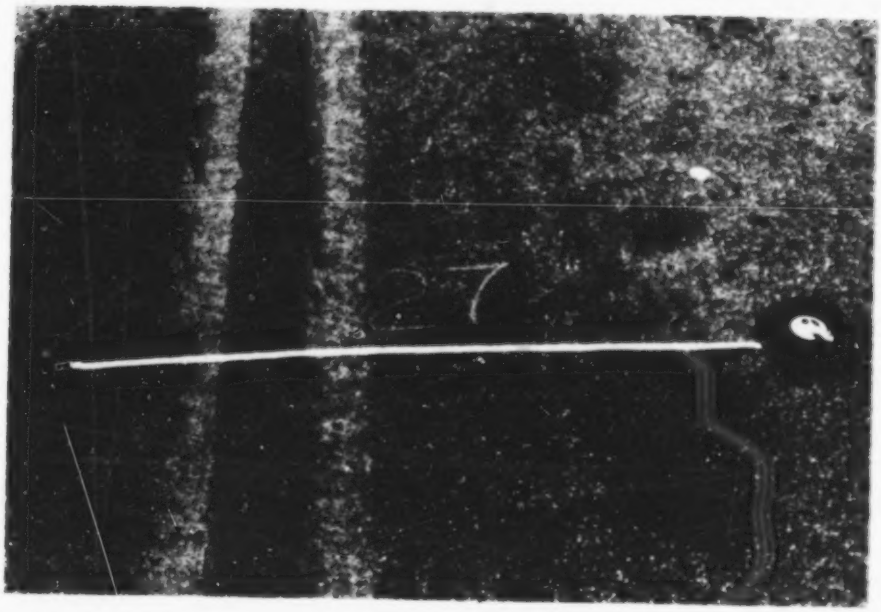
Condition Rating = 90

Figure 1. Asphalt pavement rating form.

BEST DOCUMENT AVAILABLE

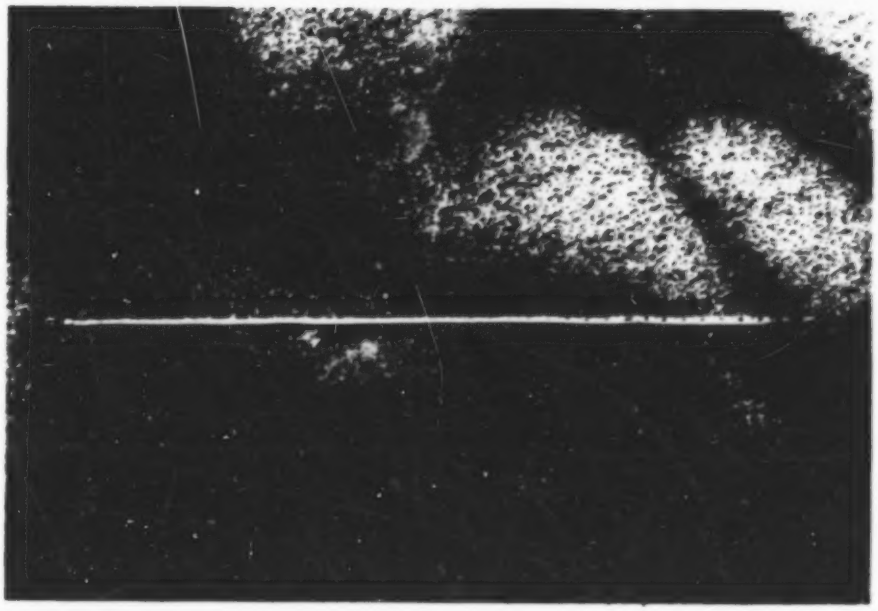
GLEN ROCK ROAD

Location: 12' west of Gruczka's mailbox, facing south, center of road in middle of uphill grade.



August 5, 1981

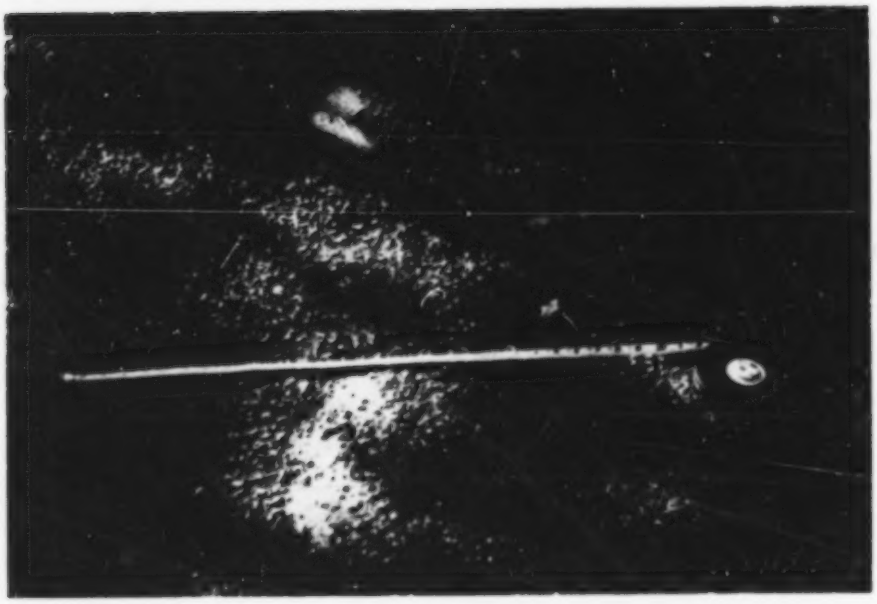
Road condition good.



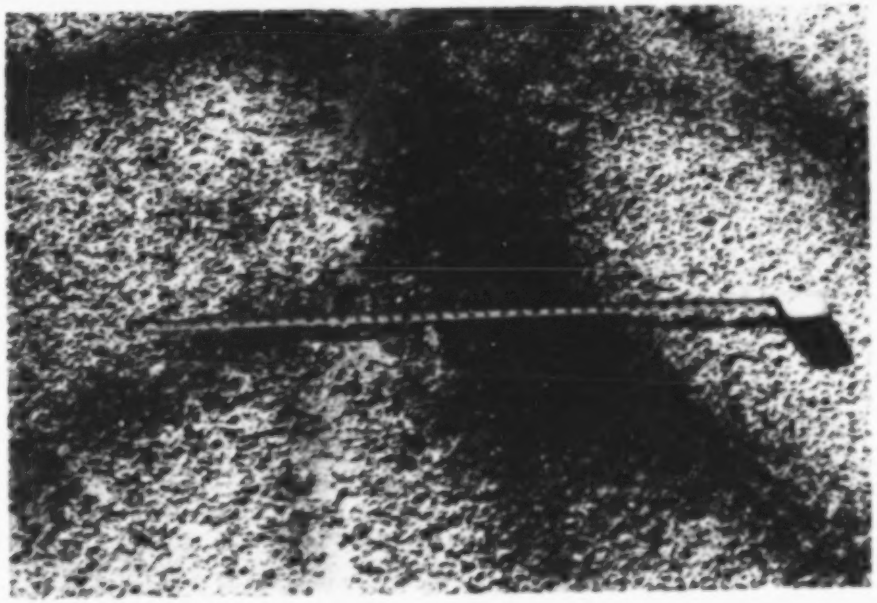
September 10, 1981

Surface fairly well sealed,but shows signs of initial stripping, no excess stone in center of road.

BEST DOCUMENT AVAILABLE



October 9, 1981
Surface shows stripping, no excess stone on road.



November 6, 1981
Minor stripping.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 8660 WIDTH 23

PAVEMENT TYPE Sand Seal DATE 8-5-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	5
Longitudinal Cracks	0-5	4
Alligator Cracks	0-10	3
Shrinkage Cracks	0-5	5
Rutting	0-10	8
Corrugations	0-5	0
Raveling ... Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	3
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	3
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	5
	Sum of Defects	36

Condition Rating = 100 – Sum of Defects

= 100 – 36

Condition Rating = 64

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 4742 WIDTH 23

PAVEMENT TYPE ½" Stone Seal DATE 9-10-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling ... Stripping	0-5	3
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	9

Condition Rating = 100 - Sum of Defects

= 100 - 91

Condition Rating = 91

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 4742 WIDTH 23

PAVEMENT TYPE ½" Stone Seal DATE 10-9-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling ..... Stripping	0-5	4
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	10

Condition Rating = 100 - Sum of Defects

= 100 - 10

Condition Rating = 90

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE Glen Rock Road CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 4742 WIDTH 23

PAVEMENT TYPE ½" Stone Seal DATE 11-6-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	2
Corrugations	0-5	0
Raveling Stripping	0-5	4
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	10

Condition Rating = 100 - Sum of Defects

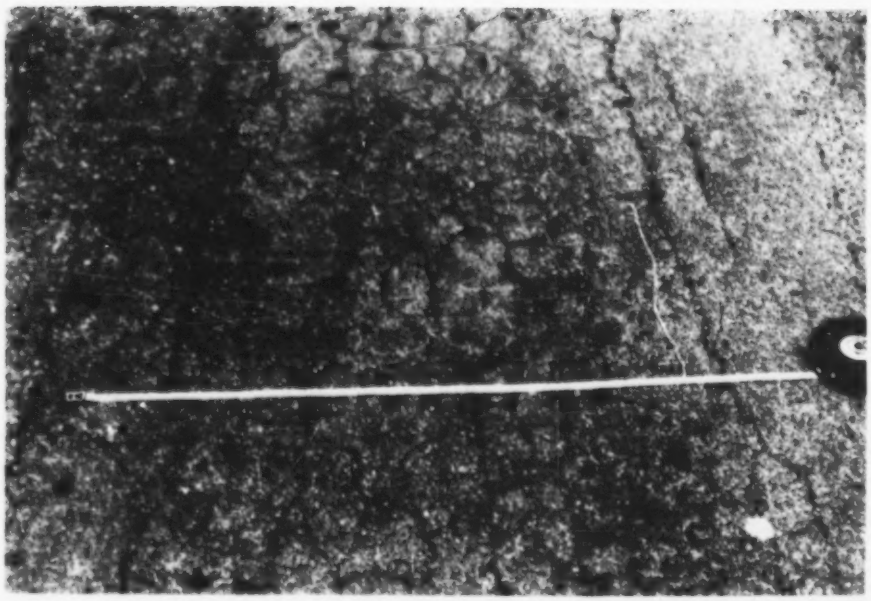
= 100 - 10

Condition Rating = 90

Figure 1. Asphalt pavement rating form.

BEST DOCUMENT AVAILABLE

JAMES TRAIL
Location: 16' north of N.E.Co. pole #8670
facing west, north side of narrow road.

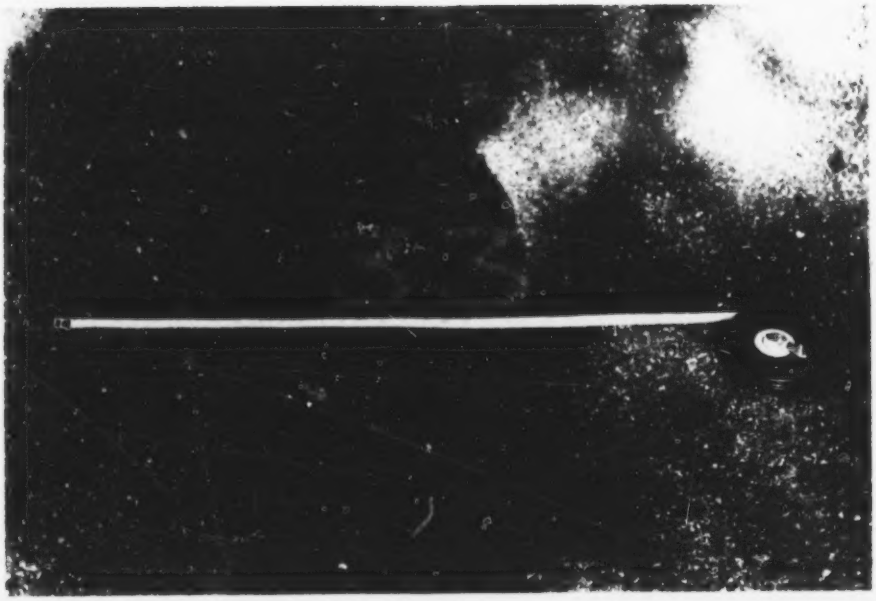


August 5, 1981
Shows alligator cracking.

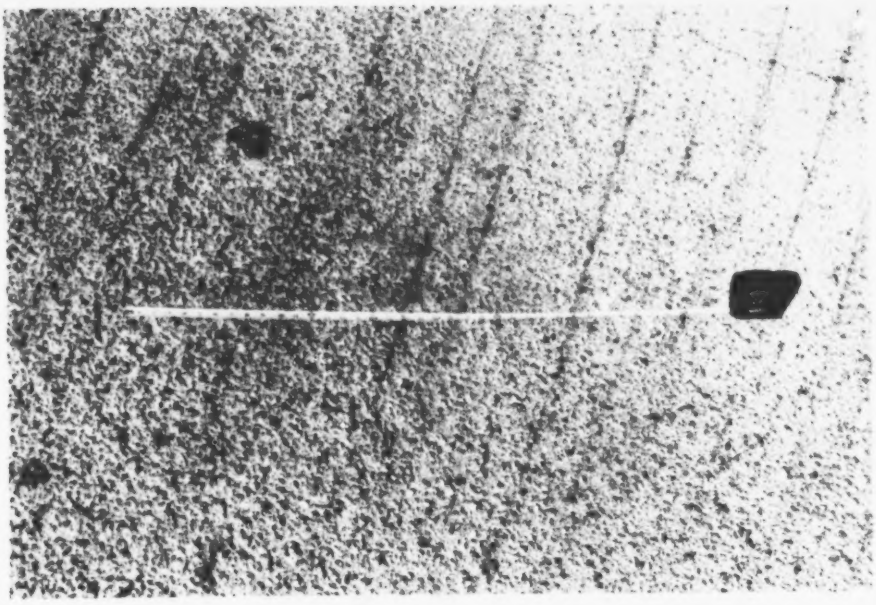
September 10, 1981
Surface well sealed, moderate excess
stone on edge of road.

BEST DOCUMENT AVAILABLE

JAMES TRAIL



October 9, 1981
Surface well sealed, no excess stone on road.



November 6, 1981
Surface well sealed.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE James Trail CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 1943 WIDTH 16

PAVEMENT TYPE Sand Seal DATE 8-5-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	5
Longitudinal Cracks	0-5	3
Alligator Cracks	0-10	10
Shrinkage Cracks	0-5	5
Rutting	0-10	3
Corrugations	0-5	0
Raveling .... Stripping	0-5	0
Shoving or Pushing	0-10	0
Pot Holes	0-10	5
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	6
	Sum of Defects	39

Condition Rating = 100 - Sum of Defects

= 100 - 39

Condition Rating = 61

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE James Trail CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 1943 WIDTH 16

PAVEMENT TYPE Stone Seal DATE 9-10-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	1
Corrugations	0-5	0
Raveling Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	6

Condition Rating = 100 - Sum of Defects

= 100 - 6

Condition Rating = 94

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE James Trail CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 1943 WIDTH 16

PAVEMENT TYPE Stone Seal DATE 10-9-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	1
Corrugations	0-5	0
Raveling .... Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	6

Condition Rating = 100 - Sum of Defects

= 100 - 6

Condition Rating = 94

Figure 1. Asphalt pavement rating form.

ASPHALT PAVEMENT RATING FORM

STREET OR ROUTE James Trail CITY OR COUNTY South Kingstown

LENGTH OF PROJECT 1943 WIDTH 16

PAVEMENT TYPE Stone Seal DATE 11-6-81

(Note: A rating of "0" indicates defect does not occur)

DEFECTS		RATING
Transverse Cracks	0-5	0
Longitudinal Cracks	0-5	0
Alligator Cracks	0-10	0
Shrinkage Cracks	0-5	0
Rutting	0-10	1
Corrugations	0-5	0
Raveling Stripping	0-5	1
Shoving or Pushing	0-10	0
Pot Holes	0-10	0
Excess Asphalt	0-10	0
Polished Aggregate	0-5	0
Deficient Drainage	0-10	2
Overall Riding Quality (0 is excellent; 10 is very poor)	0-10	2
	Sum of Defects	6

Condition Rating = 100 - Sum of Defects

= 100 - 6

Condition Rating = 94

Figure 1. Asphalt pavement rating form.